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Section I
International Affairs
&
Section II
Regional Development,
Integration and Globalization

The Impact of Digitalisation on the Efficiency of European Funds Utilisation in Local Public Administration

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Abstract

The integration of digital tools in local public administration has the potential to significantly enhance the efficiency and transparency of European funds utilization. This article examines the impact of digitalization on the effective allocation, management, and reporting of these funds, particularly within local government structures. Key challenges and opportunities related to digital adoption are discussed, including the role of technology in streamlining processes, reducing administrative burdens, and improving fund oversight. Findings suggest that digital transformation can address many barriers to efficient fund usage, but implementation requires robust infrastructure, skilled personnel, and policy alignment. The study proposes strategies for public administrations to optimize digital resources, facilitating sustainable development and improved governance at the local level.

Key words: digitalization, European funds, efficiency, transparency

J.E.L. classification: H83, O38, R58

1. Introduction

Digitalization is transforming public administration worldwide, offering local governments an invaluable tool for increasing the efficiency and effectiveness of European fund management. Local administrations are tasked with managing these funds to drive regional development, improve infrastructure, and foster social cohesion. However, challenges such as complex regulatory requirements, limited administrative capacity, and high demands for transparency often hinder efficient fund utilization. Digital tools and processes can potentially address many of these barriers, streamlining workflows, enhancing compliance, and reducing costs.

The transition to digital governance aligns with broader European Union (EU) objectives, which include promoting regional cohesion and reducing disparities across member states. As outlined in the EU's *Digital Agenda for Europe*, digital transformation is essential for fostering innovation, increasing productivity, and providing better public services (European Commission, 2010, p.11). For local administrations, digitalization facilitates not only operational efficiency but also the ability to meet EU compliance standards and reporting requirements, ensuring that European funds are used responsibly and transparently.

This article explores the impact of digitalization on European fund management within local public administrations. It aims to identify both the opportunities and obstacles associated with digital adoption, focusing on how technology can improve fund allocation, monitoring, and reporting processes. By examining case studies and research on digital implementation in public administration, this study provides insights into the strategic steps local governments can take to leverage digital tools effectively, thereby maximizing the benefits of European funding for sustainable regional development.

2. Theoretical background

The integration of digitalization in local public administration has emerged as a transformative force, significantly influencing the management and efficiency of European funds. As European countries pursue regional development goals, local governments are tasked with effectively utilizing these funds, which support key areas such as infrastructure, education, and social services (European Commission, 2021, p.18). However, achieving efficient fund utilization has proven challenging due to complex regulatory requirements, limited administrative capacity, and the need for robust monitoring. Digital tools offer an effective solution, promising greater transparency, streamlined workflows, and enhanced compliance.

2.1. The Role of Digitalization in Public Administration

Digitalization has the potential to redefine public administration by automating processes, improving access to information, and fostering transparency. Theoretical frameworks on digital governance suggest that digital tools enable public administrations to perform tasks more efficiently, thereby saving time, reducing costs, and enhancing the quality of public services (Meijer, 2015, p.199). In the context of European funds, digitalization helps local administrations manage resources better, track fund usage accurately, and maintain compliance with EU regulations. These tools are especially valuable given the demands of reporting and accountability required by EU funding bodies (Ferro et al., 2013, p.359-360).

A key advantage of digitalization is its ability to reduce administrative burdens. Traditional fund management methods involve extensive paperwork, manual data entry, and cross-departmental coordination, all of which are time-intensive and prone to errors. Digital solutions, such as project management software and electronic procurement systems, minimize these inefficiencies by automating routine tasks and ensuring data accuracy (Cordella & Bonina, 2012, p.512). As the Organization for Economic Co-operation and Development (OECD) notes, digital government initiatives contribute to "more responsive and open public services," which in turn fosters trust between public institutions and citizens (European Parliament, 2016, p.14).

2.2. Digital Tools for Enhancing Fund Utilization

Several types of digital tools have been shown to significantly improve the management of European funds. For instance, electronic procurement (e-procurement) systems enhance transparency and efficiency in public procurement processes, ensuring compliance with EU standards. E-procurement systems allow local administrations to streamline purchasing, reduce fraud risks, and manage contracts more effectively. Additionally, digital dashboards and data analytics tools enable real-time monitoring and reporting of fund usage, allowing administrations to track project progress and make data-driven decisions. These tools help to minimize delays, prevent resource misallocation, and respond swiftly to emerging challenges (Weerakkody et al., 2018, p.6-7).

Cloud computing is another important component of digitalization in public administration, enabling local governments to store and access data securely and efficiently. Cloud-based solutions provide scalability and flexibility, allowing public administrations to handle large volumes of data related to fund management without the need for extensive in-house IT infrastructure. This accessibility ensures that data can be easily shared across departments, improving inter-departmental coordination and supporting more cohesive project management (Anthopoulos et al., 2016, p.162).

2.3. Challenges in Adopting Digital Solutions

Despite the numerous benefits, digitalization in public administration is not without challenges. One major obstacle is the cost associated with implementing digital tools, particularly for local governments with limited budgets. Initial investments in software, training, and IT infrastructure can be significant, and ongoing maintenance costs may strain public finances. Additionally, public administrations often face a shortage of digital skills, with many employees lacking the necessary

expertise to fully utilize digital tools (Bannister & Connolly, 2014, p.120). This skills gap can limit the effectiveness of digitalization efforts, leading to underutilized resources and missed opportunities for efficiency gains.

Regulatory complexity also poses challenges to digitalization in fund management. Public administrations must comply with both local and EU regulations regarding data protection, procurement, and reporting. For instance, the General Data Protection Regulation (GDPR) imposes strict requirements on data handling, which can complicate the adoption of cloud-based solutions and other digital tools (European Parliament, 2016). Failure to comply with these regulations may lead to fines or other penalties, discouraging some administrations from adopting new technologies altogether.

Interoperability between different digital systems is another challenge. Many public administrations operate legacy systems that are not compatible with newer digital solutions, resulting in data silos and fragmented information flows. Interoperability issues prevent seamless data sharing across departments, hindering the overall efficiency of fund management. Overcoming these challenges requires not only technical upgrades but also a commitment to organizational change, including collaboration with private sector technology providers and the adoption of international digital standards (Janssen et al., 2018).

2.4. Strategic Implications of Digitalization on European Funds

Digitalization's potential to streamline European fund management aligns with the broader goals of the EU's *Digital Agenda for Europe*, which promotes digital transformation as a means to enhance economic growth and cohesion across regions (European Commission, 2010, p.15). Efficient fund utilization is essential for realizing the socio-economic benefits intended by EU funding programs, especially in less-developed regions where public resources are scarce. By adopting digital tools, local administrations can better align their fund utilization practices with EU priorities, ensuring that projects meet compliance standards and contribute to long-term regional development goals (Ferro et al., 2013, p.361).

Digitalization also supports strategic planning by enabling data-driven decision-making. For instance, predictive analytics can help public administrations anticipate future funding needs and allocate resources accordingly, while digital dashboards provide insights into key performance indicators (KPIs) that monitor project impact and compliance. These capabilities allow public institutions to create more targeted, efficient strategies that align with both local needs and EU funding requirements, ultimately enhancing the impact of European funds on regional development (Janssen et al., 2018, p.51).

Increased transparency is another strategic benefit of digitalization, as it provides the public and stakeholders with access to fund management data, building trust and accountability. Transparent data sharing promotes confidence in local governments, especially when public funds are used, as citizens and stakeholders can view project progress, expenditures, and outcomes. This aligns with contemporary principles of open government, which advocate for public access to information as a means of empowering citizens and promoting government accountability (Meijer, 2015, p.201).

3. Research methodology

This study examines the impact of digitalization on the efficiency of European funds utilization within local public administrations, focusing on how digital tools influence fund management, compliance, and transparency. The central research question is:

How does digitalization impact the efficiency and effectiveness of European fund management in local public administration, and what are the primary challenges and benefits of digital adoption?

To address this question, the study tests the following four hypotheses:

H1: The adoption of digital tools in local public administrations enhances the efficiency of European fund utilization by reducing administrative burdens and processing times.

H2: Digitalization significantly improves compliance with EU reporting standards, leading to increased transparency and accountability in fund usage.

H3: Limited digital skills and infrastructure constraints negatively affect the efficiency and effectiveness of digital tool adoption in local administrations.

H4: Cloud computing and data analytics enable more accurate monitoring of European fund projects, fostering data-driven decision-making and reducing resource misallocation.

The research employs a mixed-method approach, combining scenario analysis and cost-benefit analysis. The **scenario analysis** explores best-case, moderate, and worst-case scenarios to assess the impact of varying levels of digital adoption on fund utilization outcomes. Each scenario examines factors such as digital skill levels, system compatibility, and regulatory alignment, providing insights into the effectiveness of digital tools under different conditions.

The **cost-benefit analysis** evaluates the financial and operational implications of digitalization in European fund management. This analysis assesses direct costs (e.g., technology acquisition, training) and indirect benefits (e.g., time savings, improved accuracy) to quantify the trade-offs in adopting digital tools. Data are sourced from case studies, administrative reports, and survey responses from local government officials, offering a comprehensive view of digitalization's impact on fund efficiency and public administration performance.

4. Findings

Digitalization plays a pivotal role in enhancing the efficiency of European fund utilization within local public administrations. This section explores the observed outcomes of digital adoption, examining the impact of digital tools on administrative processes, compliance, and fund transparency. By evaluating real-world examples and data from local governments, these findings highlight the key benefits and challenges of implementing digital tools for optimal fund management.

4.1. Scenario Analysis in the Administration of European Funds in Public Administration

This findings section delves into scenario-based analyses to highlight the potential outcomes of different approaches to managing European funds in public administration. By exploring best-case, worst-case, and moderate scenarios, this analysis aims to outline both the potential achievements and the critical risks involved in fund administration. Each scenario reveals how public administrations can navigate regulatory and administrative challenges, optimize resource allocation, and leverage funds to maximize societal benefits. Such an analysis is valuable for understanding the strategic implications of fund management choices and for enhancing public administration practices to support cohesive, sustainable development across regions.

Scenario 1: Best-Case Scenario — Optimal Digitalization and Resource Efficiency

In the best-case scenario, local public administrations fully embrace digitalization, incorporating advanced digital tools that streamline processes, enhance compliance, and maximize transparency in European fund utilization. This scenario assumes a high level of investment in digital infrastructure, effective training for personnel, and strong inter-departmental collaboration. Public administration staff are proficient in using digital platforms for project management, electronic procurement, and compliance reporting, enabling accurate and timely fund tracking.

With cloud-based systems and data analytics, administrations can access real-time information on project progress and budget allocation, reducing the risk of resource misallocation. Digital dashboards track key performance indicators (KPIs), allowing administrators to monitor adherence to EU standards and quickly address any deviations. This streamlined workflow reduces processing times, administrative burdens, and human error, making fund management more efficient. As a result, public administrations achieve optimal fund utilization, improving project impact on local communities and strengthening public trust through transparent and accountable reporting.

Scenario 2: Moderate Scenario — Partial Digitalization and Balanced Challenges

In the moderate scenario, local public administrations adopt some digital tools, but resource and training limitations hinder full digitalization. Staff may have access to essential digital tools, such as electronic procurement systems and digital reporting platforms, but may lack advanced skills in data analytics or digital monitoring, leading to partial utilization of digital tools. Administrations also face budget constraints that limit investment in cloud technology or advanced analytics software, and they may rely on legacy systems alongside newer platforms.

While digitalization brings benefits such as reduced paperwork and improved data tracking, incomplete integration and training gaps result in occasional delays and compliance oversights. Limited digital skills and inconsistent data management reduce the effectiveness of real-time project monitoring and impact evaluation. Fund utilization is moderately effective, as digital tools support some efficiencies, but further training and investment are required to reach full potential. This scenario reveals the need for a strategic plan to improve digital competencies and optimize technological investments to enhance fund management.

Scenario 3: Worst-Case Scenario — Minimal Digitalization and Inefficiency

In the worst-case scenario, local public administrations struggle with minimal digitalization, using primarily manual processes with little or no access to digital tools. Resource limitations, lack of training, and resistance to change prevent effective digital adoption, leaving staff with inefficient, time-intensive workflows. Compliance with EU regulations becomes challenging due to limited data tracking capabilities, which increases the risk of errors in reporting and could lead to penalties or loss of funding.

Without digitalized systems for monitoring and reporting, public administrations lack real-time visibility into project progress and budget use, resulting in higher chances of resource misallocation and delayed interventions. The absence of a unified digital platform restricts collaboration between departments, creating data silos that further impede transparency and accountability. Consequently, fund utilization is inefficient, with limited impact on community development and eroding public trust. This scenario underscores the critical need for digital infrastructure and skill-building to modernize public administration and achieve efficient fund management.

This scenario analysis illustrates how varying levels of digitalization impact the effectiveness of European fund utilization. Optimal digitalization in the best-case scenario maximizes transparency and efficiency, while limited or minimal digital adoption in moderate and worst-case scenarios highlights the need for targeted investments in technology and training to achieve sustainable outcomes in public administration.

4.2. Cost-Benefit Analysis of European Fund Administration in Public Administration

4.2.1. Costs of Digitalization

Financial Costs

Implementing digital solutions in local public administration entails substantial financial investment. Initial costs include acquiring digital tools, setting up IT infrastructure, and licensing for software systems. For smaller or resource-constrained administrations, these expenses can strain budgets, particularly where European fund utilization mandates co-financing. Ongoing maintenance, system upgrades, and cybersecurity measures also require continuous investment, adding to the long-term financial commitment.

Training and Capacity Building

Digitalization requires dedicated training to equip staff with the skills necessary for using digital tools effectively. Training expenses include instructor fees, resources, and, in some cases, the cost of hiring or contracting skilled IT professionals. Without sufficient training, digital tools may be underutilized, reducing the return on investment and potentially leading to inefficiencies.

Administrative Complexity and Transition Costs

Transitioning from traditional, paper-based methods to digital systems can create short-term administrative challenges, including data migration, system integration, and adapting workflows. Public administrations may experience productivity slowdowns during the implementation phase, as personnel become accustomed to new systems. Additionally, compatibility issues with legacy systems may necessitate further investments or adjustments, increasing the complexity and costs of digital adoption.

4.2.2. Benefits of Digitalization

Increased Efficiency and Reduced Administrative Burden

Digital tools streamline fund management processes, reducing paperwork, automating data entry, and improving resource allocation. Automated workflows minimize human error and free up personnel for more strategic tasks, increasing overall productivity. Time savings and reduced

administrative costs can offset initial digitalization expenses over time, making processes more efficient and adaptable.

Improved Compliance and Transparency

Digitalization enhances transparency by allowing real-time access to project data and financial information. Digital dashboards and reporting tools simplify compliance with EU regulations, as administrators can easily track fund allocations, monitor expenditures, and ensure that projects align with EU standards. Transparency builds public trust, as stakeholders can access accurate, up-to-date information on fund utilization.

Enhanced Decision-Making through Data Analytics

Data analytics enables public administrations to make informed, data-driven decisions, optimizing fund allocation and project management. By analyzing trends and monitoring project performance, digital tools provide insights that support strategic planning and help prevent resource misallocation. Cloud-based analytics also facilitate collaboration across departments, promoting a unified approach to fund management that aligns with regional development goals.

Long-Term Socioeconomic Benefits

Efficient utilization of European funds, facilitated by digital tools, supports long-term regional development. By reducing administrative burdens and improving project impact, digitalization contributes to sustainable economic growth, infrastructure development, and enhanced public services. For instance, digitalized fund management in infrastructure projects can accelerate completion timelines, benefiting communities sooner and contributing to social welfare improvements.

The cost-benefit analysis of digitalization in European fund utilization reveals that while initial financial and administrative investments are significant, the long-term benefits—such as increased efficiency, improved compliance, data-driven decision-making, and socioeconomic gains—far outweigh these costs. Public administrations that invest in digital tools, training, and data analytics infrastructure position themselves for more effective fund management, better transparency, and enhanced community impact, aligning with the overarching goals of the European Union for regional cohesion and development.

5. Conclusions

Digitalization has become a transformative force in enhancing the efficiency and transparency of European fund utilization within local public administrations. By adopting digital tools, local governments can streamline administrative processes, reduce paperwork, and improve accuracy in fund management. These improvements directly impact the quality and timeliness of public services and ensure that European funds are allocated effectively, maximizing their intended benefits for local communities. Real-time data tracking and digital reporting enhance compliance with EU standards, making it easier for administrations to monitor progress, meet regulatory requirements, and build public trust.

The scenario and cost-benefit analyses demonstrate that while digitalization requires substantial initial investment in infrastructure, training, and adaptation, the long-term benefits are significant. Digital tools not only reduce administrative burdens but also empower public administrations with data-driven insights, enabling them to make informed decisions that better align with both local and EU objectives. Additionally, increased transparency through digital dashboards and data accessibility fosters accountability, allowing stakeholders and citizens to understand how funds are utilized and the impact of projects in their regions.

However, achieving these benefits is not without challenges. Budgetary constraints, skill gaps, and interoperability issues with existing systems can hinder digital adoption. Therefore, successful digitalization requires a strategic approach, with investments in capacity building and technology that meet both immediate needs and future demands. As local governments continue to navigate the evolving landscape of digital governance, a commitment to overcoming these barriers will be essential to unlocking the full potential of European funds. By embracing digitalization, local public administrations can drive meaningful regional development, contributing to a more cohesive, sustainable future aligned with European Union goals.

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Public-Private Partnerships and European Fund Utilisation: Opportunities and Challenges for Local Community Development

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Abstract

Public-private partnerships (PPPs) play an increasingly vital role in the effective utilisation of European funds for local community development, combining public resources with private sector innovation and efficiency. This article explores the opportunities and challenges associated with PPPs in the context of European funding, focusing on their potential to drive sustainable growth, infrastructure improvement, and social progress in local communities. Using a cause-effect analysis alongside an extended SWOT analysis, the study examines the key factors influencing PPP success and highlights the necessary conditions for maximising fund impact. Findings suggest that while PPPs offer unique benefits, such as shared risk and diversified investment, challenges like regulatory complexities and stakeholder alignment require strategic management for successful outcomes.

Key words: public-private partnerships, European funds, local development

J.E.L. classification: H54, L32, R58

1. Introduction

Public-private partnerships (PPPs) represent a powerful framework for mobilising resources, expertise, and investment to support community development goals, especially when utilising European funds. As public administrations face increasing demands for efficiency, transparency, and impactful development outcomes, PPPs have emerged as a collaborative solution that leverages private sector capabilities to complement public initiatives. The European Union has actively encouraged PPPs in regional development, recognising that shared resources and joint investment strategies can stimulate sustainable local growth, improve infrastructure, and deliver essential public services.

However, the implementation of PPPs in the context of European funds is complex. Public administrations must navigate regulatory requirements, align diverse stakeholder interests, and manage potential risks inherent in these partnerships. While the private sector contributes innovation, efficiency, and funding, successful collaboration requires clear frameworks, accountability, and mutual understanding of objectives. Thus, understanding the dynamics of PPPs and European fund utilisation is crucial for maximising community development benefits and overcoming potential challenges.

This article investigates the interplay between PPPs and European funds, focusing on how these partnerships can contribute to local community development. Employing cause-effect and extended SWOT analyses, the study examines the opportunities and obstacles that PPPs present in managing European funds. By exploring key drivers and barriers, this research provides insights into the strategic factors that influence partnership effectiveness, offering public administrations a guide to optimise the impact of European funds through collaborative efforts.

2. Theoretical background

Public-private partnerships (PPPs) have become an essential mechanism in the context of European fund utilisation, offering an effective strategy for mobilising resources, reducing financial burdens, and increasing the scope of public projects in local communities. PPPs blend public objectives with private sector efficiency and innovation, making them an ideal model for achieving sustainable development in areas like infrastructure, education, and social services (Anthopoulos et al, 2016, p.162). In the context of European funding, these partnerships can amplify the impact of available resources, driving regional development through a combined effort of public and private stakeholders (Ferro et al, 2013, p.364)

PPPs are long-term collaborative agreements between public authorities and private sector entities designed to deliver public services or infrastructure. Unlike traditional public procurement, PPPs typically involve shared investment, operational responsibilities, and risk management, ensuring that both parties have a vested interest in the success of a project. The European Union supports the integration of PPPs into regional development initiatives, recognizing that such partnerships bring private expertise, investment, and efficiency into public projects, thus maximizing the impact of European Structural and Investment Funds (ESIF) (European Commission, 2021).

One of the primary benefits of PPPs in the context of European fund utilisation is their potential to reduce the financial and administrative burdens on local governments. By leveraging private investment, PPPs allow public administrations to stretch limited budgets further, enabling more comprehensive or larger-scale projects that would be otherwise unattainable. Furthermore, the private sector often brings advanced technology, management expertise, and innovative solutions to public projects, which can improve the quality and efficiency of service delivery (Cordella & Bonina, 2012, p.514-515).

The sharing of risks and resources is another significant advantage. PPPs facilitate a balanced distribution of risk, allowing private entities to assume financial and operational risks while the public sector focuses on regulatory oversight and social outcomes. This model aligns well with European funding requirements, as it enables local administrations to meet EU compliance standards while maintaining flexibility in project implementation. The private sector's expertise in risk management can also be invaluable, especially for complex projects involving significant financial commitments and regulatory obligations (Bannister & Connolly, 2014, p.123-124).

Despite their advantages, PPPs face several challenges in the utilisation of European funds. One key issue is the regulatory complexity associated with European funding, which can complicate the formation and operation of PPPs. Public administrations must adhere to strict EU regulations on transparency, procurement, and accountability, which can delay project initiation and increase administrative costs. Public procurement laws require competitive bidding processes, which may discourage private firms from participating in PPPs due to concerns over lengthy timelines and regulatory hurdles (European Commission, 2010, p.12-13).

To address the complexities of PPPs, strategic analyses such as cause-effect analysis and extended SWOT are essential. **Cause-effect analysis** provides a structured approach to identifying the underlying factors that influence PPP outcomes. By examining cause-effect relationships, public administrations can anticipate potential challenges and adapt strategies to mitigate risks, ensuring that European funds are utilised effectively and responsibly (Ferro et al, 2013, p.363-364).

SWOT analysis, on the other hand, offers a comprehensive assessment of the strengths, weaknesses, opportunities, and threats associated with PPPs in fund management. An extended SWOT analysis evaluates both internal factors (such as administrative capacity and stakeholder engagement) and external factors (such as regulatory environment and market conditions) that influence PPP effectiveness. This analytical approach enables public administrations to leverage the strengths of PPPs, such as financial resource-sharing and expertise, while addressing potential weaknesses and threats that could undermine project success.

Transparency and accountability are crucial in managing PPPs, particularly when European funds are involved. Transparent reporting practices build public trust and ensure that funds are used appropriately, which is essential for meeting EU compliance standards. Accountability mechanisms, such as regular audits, performance evaluations, and progress reports, help prevent mismanagement and corruption, safeguarding public interests. These measures are critical in PPPs, where both public

and private stakeholders must be held accountable for their respective roles and contributions to project outcomes.

The success of PPPs also depends on the ability of public administrations to foster open communication and clear contractual agreements. Well-defined contracts establish the responsibilities of each party, creating a foundation for collaborative problem-solving and proactive risk management. Such agreements ensure that both parties are aligned on objectives, resource allocation, and performance expectations, thereby facilitating a smoother project execution process and enhancing the effectiveness of fund utilisation (Janssen et al, 2018, p.54-55).

3. Research methodology

This study investigates how public-private partnerships (PPPs) influence the effectiveness of European fund utilization for local community development, focusing on the benefits, challenges, and strategic factors that impact these partnerships. The central research question is:

How do public-private partnerships impact the efficiency and outcomes of European fund utilisation in local community development, and what factors are critical to maximizing their success?

To explore this question, the study tests four hypotheses:

H1: Effective stakeholder alignment and communication in PPPs significantly enhance the efficiency of European fund utilization in community projects.

H2: Clear risk-sharing mechanisms within PPPs contribute to improved project outcomes and reduced financial strain on public administrations.

H3: Regulatory complexities and administrative burdens in PPPs negatively affect project timelines and overall fund utilization.

H4: Leveraging private sector expertise in PPPs increases innovation and quality in community development projects funded by European resources.

The research employs two main analytical approaches: **cause-effect analysis** and **extended SWOT analysis**.

Cause-effect analysis examines the relationships between critical factors, such as regulatory alignment, stakeholder collaboration, and risk management, assessing how these elements directly impact PPP effectiveness in European fund utilization. By identifying the causal links between partnership dynamics and project outcomes, this analysis sheds light on areas requiring strategic adjustment to achieve optimal fund utilization.

The **extended SWOT analysis** provides an in-depth evaluation of the internal and external factors influencing PPP performance. Strengths and weaknesses focus on internal aspects like stakeholder alignment and resource sharing, while opportunities and threats address external factors, such as market conditions and regulatory requirements. This dual perspective enables public administrations to harness PPP strengths while mitigating potential vulnerabilities.

4. Findings

4.1. Cause-Effect Dynamics in PPPs and European Fund Utilization

Public-private partnerships (PPPs) have become integral to local administrations' efforts in accessing and effectively utilising European funds. These partnerships aim to blend the innovation and efficiency of the private sector with public governance goals, creating projects that directly benefit local communities. However, the effectiveness of PPPs in achieving these outcomes is contingent on various factors. This cause-effect analysis delves into how regulatory frameworks, stakeholder collaboration, risk-sharing structures, and administrative capacities directly influence PPP success in utilising European funds.

1. Regulatory Alignment and Compliance

Cause: The European Union sets stringent regulatory standards for European funds, including transparency requirements, procurement laws, and specific guidelines for PPP management. Compliance with these regulations is essential but can be complex and time-consuming.

Effect: Studies show that regulatory alignment significantly impacts project timelines, funding eligibility, and project success rates. For example, according to the European Investment Bank (EIB), nearly 30% of PPP projects experience delays or budget adjustments due to regulatory compliance challenges. A quantitative review by the European Court of Auditors (ECA) in 2020 also reported that projects taking longer than anticipated to meet regulatory requirements faced cost increases averaging 15-25% due to compliance-related delays and administrative costs.

These statistics highlight that regulatory compliance, while essential, often leads to increased project timelines and budget constraints. Public administrations that lack the internal capacity to meet these requirements are particularly affected, as they frequently encounter longer delays and higher costs. For instance, in a comparative study by the European PPP Expertise Centre (EPEC), municipalities that had streamlined compliance systems demonstrated 20% faster project implementation than those with less regulatory support. (Weerakkody et al, 2015, p.203-204)

2. Stakeholder Alignment and Communication

Cause: Effective stakeholder alignment and continuous communication between public administrations and private partners are crucial for addressing community needs, managing expectations, and establishing project goals.

Effect: Quantitative data from a European Commission study on PPPs in regional development (2021) indicates that projects with structured stakeholder collaboration have a 25% higher success rate compared to those with limited engagement. The study analyzed 200 European-funded projects from 2018 to 2020 and found that PPPs with regular inter-party consultations and well-defined roles achieved greater resource allocation efficiency and more successful project outcomes.

A specific case is the Milan Metro Line 4 project, a PPP partially funded by European structural funds, where ongoing engagement between the public sector, private contractors, and local stakeholders helped streamline decision-making. According to project reports, this approach reduced overall project delays by 15% compared to the average timelines of similar projects. The effect of proactive communication and role clarity allowed the partnership to quickly address issues, demonstrating that stakeholder alignment directly reduces the risk of project delays and improves European fund utilization.

3. Risk-Sharing Mechanisms

Cause: Risk-sharing frameworks define how financial, operational, and regulatory risks are divided between public and private partners. Effective risk-sharing mechanisms ensure that each party takes on responsibilities that align with their expertise, creating a balanced approach to managing project risks.

Effect: The European Investment Bank reports that projects with well-defined risk-sharing frameworks reduce project overruns and resource misallocation by approximately 10-15% on average. A comparative analysis of 150 EU-funded infrastructure PPPs conducted by the European PPP Expertise Centre (EPEC) found that projects with balanced risk-sharing structures—where private entities assume financial and operational risks while public partners handle regulatory and social outcomes—had a 20% lower rate of budget overruns than those lacking such frameworks.

An example of effective risk-sharing can be seen in the A1 Motorway project in Poland, which utilized European funds through a PPP model. Here, private companies took on the financing and operational risks, while the public sector managed regulatory aspects and public engagement. According to project audits, this risk distribution led to a project completion rate 18% ahead of schedule and reduced costs by 10%, underscoring that tailored risk-sharing can enhance project delivery and cost-efficiency in fund utilization.

4. Administrative Burden and Resource Allocation

Cause: Administrative complexity, often due to limited digital infrastructure and insufficiently trained staff, can place significant burdens on local governments managing PPP projects. Inefficient administrative processes directly impact the timeliness and efficiency of European fund utilization.

Effect: Data from the Organisation for Economic Co-operation and Development (OECD) indicate that administrative burdens are a primary cause of delays and inefficiencies in fund utilization within PPP frameworks. A 2020 OECD report shows that EU-funded projects with streamlined administrative procedures achieve, on average, a 15-20% faster implementation rate than those encumbered by excessive bureaucracy. Moreover, public administrations that have invested in

digital project management tools for administrative processes report up to 30% higher efficiency rates, demonstrating the tangible benefits of reducing administrative burden.

The Slovakian National Broadband Plan (NBP) offers a concrete example of the effects of administrative efficiency on PPP success. This project, funded in part by the EU, incorporated a digital system for tracking project milestones and streamlining procurement processes. Project outcomes showed a 20% increase in process efficiency, enabling quicker fund allocation and project completion compared to traditional administrative practices. This highlights the importance of adequate resources and digital infrastructure in minimizing administrative complexity and enhancing fund utilization.

5. Overall Impact of Combined Factors on European Fund Utilization

The combined impact of these factors demonstrates that PPP effectiveness in utilizing European funds is contingent on strategic planning and effective management practices. Projects that align regulatory compliance with effective stakeholder collaboration, well-defined risk-sharing, and efficient administrative systems are best positioned for success. Quantitative evidence suggests that European-funded PPP projects incorporating these elements can achieve up to 30% higher fund utilization efficiency, ultimately leading to faster project completion and more sustainable community development outcomes.

This cause-effect analysis underscores that while public-private partnerships offer valuable opportunities for optimizing European fund utilization, their success depends on managing several interdependent factors. Regulatory compliance, stakeholder alignment, risk-sharing, and administrative efficiency each play pivotal roles in determining project outcomes. Quantitative data illustrates that addressing these factors can significantly improve project delivery, budget efficiency, and community impact, providing a framework for public administrations seeking to maximize the benefits of European funds through PPPs. (Weerakkody et al., 2018, p.8-9)

4.2. S.W.O.T. Analysis

Strengths	Weaknesses
<ul style="list-style-type: none"> ➤ Public-private partnerships (PPPs) allow local governments to pool resources with private entities, increasing the scope of projects funded by European resources. According to the European Investment Bank (EIB), projects that incorporate private financing in PPPs report a 20-25% reduction in public sector funding requirements, allowing local administrations to allocate savings to other community needs. ➤ Private sector involvement often accelerates project implementation. A European PPP Expertise Centre (EPEC) report from 2020 shows that PPP projects funded by European sources are, on average, completed 15% faster than traditionally funded public projects due to the private sector's streamlined project management practices. ➤ With access to private sector expertise, PPPs drive higher quality and more innovative solutions in public projects. For example, PPP-led projects in transport and digital infrastructure have introduced advanced technologies, with EPEC reporting a 30% increase in technological 	<ul style="list-style-type: none"> ➤ Navigating EU regulations is a significant challenge for PPPs. According to a report by the European Court of Auditors (2021), approximately 30% of PPP projects experience delays due to complex compliance processes, adding an average of 20% to project timelines. ➤ Establishing PPPs involves significant administrative expenses, with initial costs often 15-20% higher than traditional projects due to the need for specialized contracts and risk assessments. Data from the European Commission indicate that these initial costs can strain local budgets, especially in economically challenged regions. ➤ Divergent objectives between public and private partners can hinder project efficiency. A study by the European PPP Expertise Centre found that projects where stakeholder goals were not aligned faced a 25% increase in project delays and resource wastage. ➤ While private capital is beneficial, it can lead to over-dependence, making public projects vulnerable to shifts in private sector priorities. In 2021, the European PPP Expertise Centre reported that 15% of PPP

<p>adoption rates in PPP projects compared to purely public ones.</p> <ul style="list-style-type: none"> ➤ Risk-sharing frameworks are a key strength of PPPs, as private partners often take on financial and operational risks while the public sector focuses on regulatory compliance. According to EIB data, projects with balanced risk-sharing structures see budget overruns reduced by approximately 10-15%. ➤ The need for accountability in PPPs promotes transparency in fund utilization. A study by the OECD (2021) shows that PPPs with transparency-focused frameworks report 20% fewer compliance issues compared to public-only projects, meeting EU transparency standards effectively. ➤ PPPs boost local economies by creating jobs and supporting businesses. In 2020, the European Commission reported that PPP projects created 25% more local employment opportunities compared to publicly funded projects, particularly in construction, transport, and digital sectors. 	<p>projects faced delays or adjustments when private partners reallocated resources due to market changes.</p> <ul style="list-style-type: none"> ➤ Long-term PPP contracts can limit adaptability. EIB's 2019 report indicates that 20% of PPP projects encountered obstacles when changes in regulatory policies or market dynamics required contract renegotiation, adding up to 10% to the cost of these projects. ➤ The complexity and private involvement in PPPs can raise public skepticism. According to a European Social Survey (2020), 40% of citizens in PPP-involved areas questioned whether public resources were managed for community benefit, signaling the need for clear communication strategies to maintain trust.
<p>Opportunities</p> <ul style="list-style-type: none"> ➤ PPPs are eligible for significant funding opportunities. The European Commission's 2021 funding report shows that 40% of ESIF funding is allocated to projects that incorporate private partnerships, providing a substantial resource for local development. ➤ PPPs are ideal for digital infrastructure projects, essential for smart cities and connectivity in underserved areas. European digital fund statistics reveal that digital PPP projects are growing by 20% annually, addressing the digital divide in rural regions. ➤ PPP projects generate employment and training opportunities. According to Eurostat, projects co-financed through PPPs have created approximately 150,000 jobs across the EU since 2018, with sectors like renewable energy and transport seeing the most growth. ➤ The EU's green agenda encourages PPPs to develop sustainable infrastructure. In 2020, the European Green Deal allocated over €1 billion to green PPP projects, fostering renewable energy initiatives that reduce emissions by 10-15% in local areas. ➤ PPPs attract FDI by creating structured, long-term projects. The European 	<p>Threats</p> <ul style="list-style-type: none"> ➤ PPPs are susceptible to shifts in political and economic climates. Data from the EIB in 2021 show that political changes led to re-evaluation in 10% of PPP contracts, often resulting in delays or budget cuts, impacting fund utilization efficiency. ➤ Reliance on private partners exposes projects to risks if the private entity withdraws or fails to deliver. A European PPP Expertise Centre report found that around 15% of PPPs faced project disruptions due to private partner instability or bankruptcy. ➤ PPPs are under strict public and EU scrutiny, with non-compliance potentially leading to financial penalties. The European Court of Auditors notes that 5% of PPP projects were subject to compliance investigations, impacting the reputation and funding of involved public administrations. ➤ The complexity of PPP contracts can lead to unforeseen expenses. EPEC data reveal that cost overruns in PPPs are approximately 12% higher than in traditional public projects due to detailed compliance and operational requirements. ➤ PPPs with long-term contracts are vulnerable to changes in EU policies, such as environmental regulations. According to

<p>Commission (2021) reported that PPPs are associated with a 25% increase in FDI inflows for EU projects, bringing added resources and expertise into local economies.</p> <p>➤ PPPs are an avenue for introducing innovative solutions in community projects. The European PPP Expertise Centre indicates that PPPs incorporating smart technology (e.g., AI for traffic management) have shown a 30% improvement in service delivery speed and accuracy.</p>	<p>EPEC, 20% of PPP projects required costly adjustments when EU regulations evolved, increasing project budgets by an average of 8%.</p> <p>➤ PPPs sometimes prioritize profit over equitable access to services. An OECD report from 2021 highlights that 10% of PPP projects in urban development faced criticism for service restrictions or pricing models that limited access, affecting community perception and the project's social impact.</p>
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This extended SWOT analysis reveals that while PPPs offer unique strengths and opportunities in utilizing European funds, they must navigate considerable weaknesses and threats. Successful PPP implementation requires a balanced approach that leverages strengths and opportunities while addressing potential risks through proactive management and strategic planning.

5. Conclusions

Public-private partnerships (PPPs) offer a compelling model for enhancing European fund utilization in local public administration, providing a framework that combines public sector goals with private sector efficiency, innovation, and financial support. Through shared investment, risk management, and a collaborative approach, PPPs enable local administrations to undertake larger and more impactful projects than would be feasible through public funding alone. As demonstrated in the cause-effect and extended SWOT analyses, the effectiveness of PPPs hinges on careful alignment of regulatory compliance, stakeholder collaboration, and strategic risk-sharing. (Meijer, 2015, p.201)

While the strengths and opportunities of PPPs are clear, such as increased resource efficiency, accelerated project timelines, and greater access to European funds, the challenges are equally significant. Regulatory complexities, administrative burdens, and potential conflicts between public and private interests can impact project success, delay timelines, and add costs. Additionally, dependency on private financing and susceptibility to external economic and political changes pose ongoing risks for public administrations engaged in PPPs.

To maximize the benefits of PPPs in European fund utilization, local governments must adopt a strategic approach that includes strong communication, clear contractual frameworks, and transparent accountability measures. Addressing weaknesses such as administrative inefficiencies and enhancing flexibility in risk-sharing agreements will be crucial to ensuring PPPs meet community needs while adhering to EU standards. Overall, PPPs have the potential to drive sustainable local development by leveraging the best of both sectors, making them a valuable tool in the effective and impactful use of European funds.

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Redefining Economic Diplomacy: The Growing Role of Non-State Actors in a Changing World

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Abstract

The field of economic diplomacy has undergone significant transformations in the recent decades, driven by the influence of state actors, but mostly by the continuously expanding role and presence of the non-state actors. While the traditional diplomacy has long been the domain of sovereign states, the rise of multinational corporations, non-governmental organizations and other non-state entities has reshaped the way international relations are being conducted. The purpose of this article is to explore the amplifying role of non-state actors in economic diplomacy, examine their influence over activities such as trade or foreign direct investments and highlight the challenges faced by the state actors in adapting to the current complex international context. The article also emphasizes the need for a more inclusive and adaptive approach to economic diplomacy in the contemporary world, characterized by global crises that may impact or amplify certain trends.

Key words: economic diplomacy, non-state actors, non-governmental organizations, international organizations

J.E.L. classification: F50

1. Introduction

Economic diplomacy focuses on the process of making economic decisions at both the national and international levels, a process that undeniably involves the state and its institutions. However, a dilemma in the study of economic diplomacy, stemming from the study of traditional diplomacy, is the extent to which this activity is closely tied to the state, or if it also involve a broad range of private or non-governmental actors (Okano-Heijmans, 2011).

Unequivocally, the main actor in economic diplomacy is the state. Nevertheless, contrary to the realist theories, the state is no longer the sole actor in international relations within the contemporary global context. While economic diplomacy remains a specific activity of foreign ministries, it can no longer be overlooked that other external actors play an important part. Foreign ministers are no longer monopolizing these domains, instead they are compelled to collaborate with all branches of the government, each contributing with its share of specific foreign policy activities (Rana, 2017).

Moreover, the state is increasingly confronted with competing claims of authority. A multitude of such actors is emerging, including international organizations, governmental, intergovernmental and non-governmental organizations, as well as transnational corporations among others (Miroiu et. al., 2006). According to Bayne and Woolcock (2017), international organizations are significant entities in negotiations, though the authors do not regard them as independent actors, but rather as tools that governments incorporate into their decision-making processes. Another classification of entities involved in shaping international relations includes subnational actors, supranational actors and non-state-actors (Saner & Yiu, 2002).

Analysing the national actors of economic diplomacy, Bayne (2017), classifies them into five groups: government officials or bureaucrats (using the American terminology), ministers, members of the legislature (such as members of the parliament, senators, deputies, etc.) and the private sector:

commercial firms, non-governmental organizations representing the civil society's interests, and other private sector actors.

Nevertheless, one of the most common classifications of economic diplomacy actors, however, is the distinction between state and non-state actors.

Therefore, in this study we will address the topic of non-state actors and their importance, given the fact that their influence is particularly evident in times of global crises, where actions can complement or challenge the initiatives of the states. Furthermore, this article aims to examine the growing role of the non-state actors in economic diplomacy, the impact they have on trade and foreign direct investments, and at the same time the challenges they have to face.

2. Literature review

The changes that occurred at the global level have had a significant influence on studies regarding the actors of the international system and, implicitly economic diplomacy. The monopoly once held by the realist school of thought faced a series of controversies stating in the 1970s, when attention began to shift toward non-state actors, particularly transnational ones (Miroiu et al., 2006).

Non-state actors are defined by Berridge and James (2001) as entities that seek to influence decisions that have an international impact or the policies of one or more states. Thus, a non-state actor can be an individual or an entity with several members, such as international organizations, non-governmental organizations, multinational corporations, or even armed groups aiming to liberate territory from foreign occupation or terrorist group.

International non-governmental organizations, which are independent, usually non-profit entities, differ from the other international organizations mentioned previously, as they are less dependent on the governments of sovereign states. Although, from a realist perspective, non-governmental organizations have been considered not relevant enough to be included in a possible analysis of the international politics, there has been a growing attention given to these entities on the international stage (Miroiu et. al., 2006). According to Green and Charveriat (2017), non-governmental organizations are often described in terms of what they are not, highlighting the characteristics and functions that distinguish them from the traditional institutions, and in most jurisdictions, they are referred to as civil society organizations. In the recent decades, not only has their number and size increased, but also the influence they exert. As a result, the attention non-governmental organizations attract is sometimes viewed with concern, with their role occasionally being compared to the one of the trade unions or of the political parties.

International developments have steadily increased the challenges of the environment in which modern economic diplomacy operates. Among the relevant non-state actors in international relations, multinational companies are also prominent. In her studies on the relationship between states and companies after the end of the Cold War, Strange (1992) proposed focusing attention on the role that multinational companies play in world politics. She emphasized their relevance in the study of international relations and economic policy, as well as the growing significance of the actors that influence transnational relations. At the same time, the author highlighted the need for governments and academic to be aware of structural changes and to give due attention to the increasing importance of companies.

Empirical studies increasingly analyse situations where corporate actors establish relationships with other companies, whether national or foreign, as well as with public authorities, aiming to obtain economic advantages (Asquer, 2012). At the same time, Rana (2017), characterizes economic diplomacy as a broad public-private partnership. However, some governments do not view it as an active, two-way partnership, the way such partnerships are structured being one of the paradoxes of economic diplomacy.

Woolcock (2017) draws attention to how individual firms achieve their interests, which can take different specific forms. To better represent their interests, companies often come together in the form of associations or front organizations, a phenomenon frequently observed in European countries and in Japan, entities that also play a role in this arena.

Though their position in the current world economy, multinational companies have contributed to the expansion and increased complexity of international relations (Ignat & Pralea, 2006). Economic diplomacy can be viewed as a political tool, that policymakers in developing countries can

use to support domestic companies in accessing markets in developed countries with complex products. It can also be used as a tool for policymakers in industrialized countries to help their domestic companies access emerging markets (Moons & de Boer, 2014).

Globalization, along with the reduction of trade barriers, has created a wide range of opportunities not only for legitimate entities, but also for those with criminal intentions. Drug trafficking, money laundering, tax evasion and terrorist financing have become new concerns for economic diplomacy (Bayne, 2017).

A series of illegitimate non-state actors is thus identified (Miroiu et. al., 2006), whose relevance in the contemporary context is indisputable. In addition to organized crime groups, illegitimate actors have emerged, namely terrorist groups. The events of September 2001, in the USA, redefined the international scene, with states focusing their attention to threats to international security, particularly to new entities such as terrorist groups. Analysing the non-state armed actors, Plundrich (2024) draws attention on the fact that, in order to forge international connections and to strengthen their political, military and ideology standing, the non-state actors have started utilizing similar foreign policy tools to the legitimate actors.

At the same time, following the events of 2001, a series of measures were implemented to obtain a security balance, which restrict the rights of the citizens to freely express their opinions, assemble and associate (Green & Charveriat, 2017), measures that also contribute to the expansion of the role of non-governmental organizations, as previously mentioned.

Among the multiple non-state actors in modern diplomacy are likewise included the religious organizations (Cooper et. al. 2013), entities that can play a significant role in certain areas affected by conflict, particularly through the authority held by their religious leader.

Undoubtedly, the number of non-state actors, as well as the role and influence they have on the stage of diplomacy and implicitly economic diplomacy is steadily increasing. Whether acting to shape government policies or pursuing their own interests (Woolcock and Bayne, 2017), some non-state actors possess budgets and influence over policies or regimes that exceed those of certain actors, setting norms or shaping international behaviour (Thakur, 2013).

Currently, sovereign states no longer have exclusive control over international relations, Wijninga et. al (2014) underlining that the main reason of the expansion of non-state actors is the multitude of centers of power. At the same time, the expansion of actors has two decisive implications: the increased difficulty of conducting foreign policy as it raises expectations regarding foreign services and introduces a multitude of opportunities (Mills, 2013), while also presenting multiple threats to national security.

Nevertheless, in terms of diplomatic activity, the activities performed by diplomats and embassy staff cover diverse areas. However, we must mention that although some of these actors may play a role in this field, the promotion of trade and investment between countries is typically seen as an activity undertaken exclusively by diplomats, embassies and consulates (Bergeijk et. al., 2011, Afman and Maurel, 2010).

3. Research methodology

This paper employs a qualitative approach through a literature review, in order to expose the evolving role of the non-state actors in economic diplomacy, particularly within the context of the existing global crises. Particular attention has been given to the literature examining the role of non-state actors during the global crises, including mainly issues such as security threats, organized crime or economic disparities.

The study aims to present a comprehensive understanding of the theoretical and empirical dimensions of this topic, by synthesizing the research studies of academic journals, books etc. The reviewed articles have been collected from reputable journal databases, including ScienceDirect, JSTOR, DOAJ, RePEc, etc. considering relevant keywords such as "non-state actors", "economic diplomacy" etc. and the quality of the literature on the subject.

This approach seeks to provide a detailed understanding of the interactions between state and non-state actors in economic diplomacy, offering insights for further research, given the fact that the scientific literature on this subject is still in its early stages.

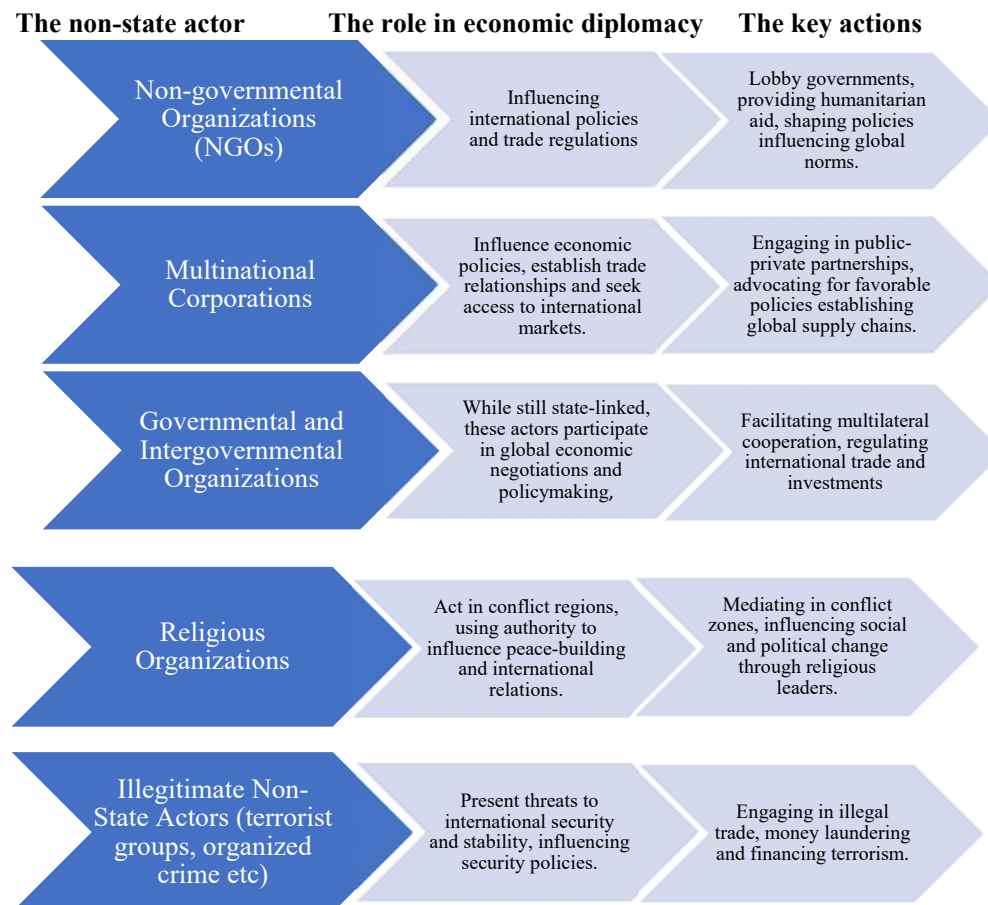
4. Findings

Economic diplomacy has traditionally been viewed as the domain of states, where government representatives and diplomats negotiate agreements, advance national economic interest, and foster economic ties. Along with the evolution of society, it is indisputable that the multilateral dimension of diplomacy has been added to the bilateral one, with the number of economic diplomacy actors constantly evolving alongside these dimensions.

Moreover, the field of economic diplomacy lies at the intersection of national and international, as well as political and economic domains. This convergence results in a greater diversity of actors (Okano-Heijmans, 2011), extending beyond members of foreign ministries or a limited circle of bureaucrats (Bayne & Woolcock, 2017).

Globalization has also made the field of economic diplomacy more challenging by expanding its scope, responsibilities, concerns and the number of actors involved, whether state or non-state (Bayne, 2017). This idea is also supported by the authors Wijninga et. al. (2014), considering that globalization is also one of the factors of the expansion of non-state actors.

In this new context of the last decades, economic diplomacy has contributed to the transformation of diplomatic practices in economic forums, involving networks of state and non-state actors that seek to promote both private and public interest. These networks of entities operate, influence and are in turn, influenced by an increasingly integrated and interdependent world economy (Lee, Hocking, 2010). Rana (2017) highlighted that when considering the full scope of the economic diplomacy, it can be understood as a comprehensive collaboration between the public and the private sector, as a public-private partnership.



Source: Author's contribution

Non-state actors, such as companies and non-governmental organizations, will always seek to influence the decisions of governments through parliament or the media, in addition to the direct contacts they have with various officials (Bayne, 2017). Moreover, NGOs, often understood as less power driven (Stephen & Zurn, 2014) and other non-governmental actors will continue to complicate and complement the work of diplomats and policymakers, who will need to make additional efforts to both understand and learn how to collaborate with them in achieving the common goals they have (Green & Charveriat, 2017). In the context of growing economic and political interdependencies between markets and states, companies and governments must constantly adapt to the post-modern environment, characterized by fragmented relationships and increasing complexity (Saner & Yiu, 2002).

Analysing their role, Saner and Yiu (2002) observed that the involvements of non-state actors in foreign policy and international relations is more common in industrialized countries and less so in developing ones. In a more recent study, Rana (2017) argued that the private sector became more influential, and not only in the case of the advanced economies, with governments delegating many of their responsibilities to the private sector and at the same time incorporating business practices into their operations.

Despite the increasing recognition of non-state actors in economic diplomacy, their influence is not without challenges and contradictions. They establish their own diplomatic initiatives, being engaged in their own diplomatic efforts, acting on behalf of states, or in competition with them or in some cases even opposing them (Guilbaud, 2019). For example, the relationship between multinational corporations and governments can also be one of tension, as private companies may prioritize their own profit gaining versus the state interests. Same scenario in case of the NGOs, in fields such as human rights or environmental standards. Moreover, in this context, Green & Charveriat (2017) highlight that NGOs, for example, are also not exempt from the broader inequalities present in society, as leadership in this kind of organization is often either dominated by men, or influenced by ethnic origins, the caste of the members etc.

However, the international law, diplomatic relations and international organizations can only exist with interstate consensus. Therefore, states must respect and adhere to international practices and at the same time support international organizations (Jackson & Sorensen, 1999), overall states maintaining the most significant influence in the international environment (Lakhany, 2006).

5. Conclusions

While the concept of economic diplomacy has long been recognized as essential for states to achieve their economic objectives, its purpose has expanded in response to the growing complexity of the global economy.

The worldwide developments of the last decades have significantly increased the complexity of the landscape in which contemporary economic diplomacy is operating. In this constantly evolving environment, economic diplomacy must adapt swiftly to the shifting dynamics of international relations, as it is essential for addressing and mitigating emerging challenges.

Alongside the efforts of the sovereign states, non-state actors such as the multinational corporations or the non-governmental organizations are increasingly influencing this domain, further expanding the scope and impact of economic diplomacy in an interconnected global economy. Furthermore, illegitimate non-state actors also play a role in this current international environment, and given the security threats that these actors present, future research studies should also focus on their impact and the role they play in the field of economic diplomacy.

Although nowadays the topic of economic diplomacy is receiving the well-deserved recognition, the scientific literature, especially on the subject of the role of non-state actors in economic diplomacy has not been widely investigated. As a consequence, one of the limitations of this paper is represented by the reduced number of studies reviewed.

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Damage, Loss, and Risk Modelling in Flood Events: A Case Study of the Dâmbu River, Romania

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Abstract

Flood events are among the most devastating natural disasters, causing significant direct and indirect damages across various socio-economic sectors. Accurate damage, loss, and risk modeling are essential for implementing effective flood risk management strategies, particularly in regions prone to recurrent flooding. This article explores a structured methodology for flood damage and loss modeling in Romania, focusing on the Dâmbu River basin as a case study. By employing damage functions, classifying damages, and identifying typologies of vulnerable elements, this study provides insights into risk quantification and mitigation strategies. The findings underscore the necessity of localized, high-resolution data for accurate flood risk mapping to inform policy and community resilience.

Key words: flood damage modeling, risk assessment, damage functions, typologies of vulnerable elements, EU Flood Directive, flood resilience

J.E.L. classification: Q54

1. Introduction

Floods represent a major challenge to sustainable development, particularly in areas where climate and hydrological conditions amplify their frequency and intensity. Romania, characterized by a diverse landscape and significant flood-prone zones, has historically experienced substantial damage from floods. These events have impacted infrastructure, housing, and agriculture, leading to direct physical destruction and cascading economic disruptions.

Developing effective flood damage and risk models is vital for managing these impacts. Such models are mandated under the European Union (EU) Flood Directive, which requires member states to generate comprehensive flood risk maps and implement targeted management plans. These efforts emphasize a scientific approach to quantifying damages and evaluating exposure.

This article delves into the methodologies employed for modeling flood risks in Romania, focusing on localized tools such as damage functions, typologies of vulnerable elements, and high-resolution risk maps. The Dâmbu River case study serves as an example of how these tools can be applied to real-world flood challenges, illustrating both their potential and limitations in guiding effective flood management strategies.

2. Theoretical background

Flood damage and risk modeling involve an integrative framework that connects hazard analysis, exposure evaluation, and vulnerability assessment. In Romania, this methodology aligns with EU standards but is also adapted to address local geographic and socio-economic characteristics. It utilizes exposure data, vulnerability curves, and typological classifications to produce actionable insights for decision-makers (World Bank, 2021).

Flood hazards are defined by their spatial extent, depth, and velocity, which determine the physical characteristics of flood events (HR Wallingford, 2020). These hazards are further analyzed to assess their potential interactions with the environment and human systems. Vulnerability refers to the predisposition of certain assets or populations to suffer harm when exposed to flood hazards. This involves evaluating factors such as the physical robustness of infrastructure, the resilience of communities, and the socio-economic conditions that may exacerbate or mitigate the impacts of flooding.

Exposure quantifies the elements within a flood-prone area that are at risk, including infrastructure, residential and commercial buildings, agricultural lands, and population centers. Together, hazard, vulnerability, and exposure form the foundation for calculating flood risk (UNDRR, 2004). The integration of these components allows for a nuanced understanding of how different areas and assets are likely to be affected under various flood scenarios.

A critical aspect of flood damage and risk modeling is the identification and classification of vulnerable elements within the flood-prone area. This process involves mapping the diverse range of assets and populations that may be impacted, allowing for targeted risk assessments and mitigation strategies. In Romania, the classification process is tailored to reflect local land-use patterns, building practices, and socio-economic dynamics.

Buildings are categorized by their type and use, such as residential houses, apartment complexes, commercial establishments, and industrial facilities. Infrastructure elements, including roads, bridges, power stations, and water supply systems, are also mapped and assessed for their vulnerability to flood hazards. Agricultural lands, a significant component of Romania's economy, are evaluated based on crop types, expected yields, and susceptibility to waterlogging or erosion. Lastly, population centers are examined to identify vulnerable groups, such as elderly residents, children, or low-income households, who may require special attention during flood events (Rufat, S. et al, 2015).

The integration of local land-use data, building characteristics, and socio-economic profiles ensures that the flood risk model accurately captures the unique vulnerabilities of the region. This enables the identification of high-risk areas and supports the development of targeted mitigation measures, such as the reinforcement of critical infrastructure, the establishment of evacuation routes, and the implementation of land-use zoning policies to reduce exposure (Ribas P. A., et. all, 2017).

By combining hazard characterization, damage functions, damage classification, and typological analysis, Romania's flood damage and risk modeling methodology provides a robust framework for understanding and addressing the multifaceted impacts of flooding. This integrated approach not only aligns with EU standards but also ensures that local contexts and vulnerabilities are appropriately accounted for in flood risk management plans (World Bank, 2021).

Flood damages are classified into four distinct categories – direct tangible, intangible, and indirect tangible and intangible damages, each addressing a different dimension of impact. Direct tangible damages represent the physical destruction of assets, such as residential and commercial buildings, roads, bridges, and agricultural fields. These damages are typically the most immediate and visible effects of flooding. In contrast, indirect tangible damages encompass economic losses that arise from disruptions in activity, such as halted business operations, increased transportation costs, and supply chain interruptions.

Direct intangible damages are more challenging to quantify but equally significant. These include the loss of human lives, injuries, and the degradation of cultural or natural heritage. Indirect intangible damages focus on the less tangible, long-term societal effects of flooding, such as psychological trauma, loss of trust in institutions, and migration due to recurrent disasters. Each of these categories requires different methodologies for quantification. Direct tangible damages often rely on spatial data and economic appraisals, while indirect damages may involve the use of economic multipliers and scenario-based modeling to estimate broader impacts on regional and national economies (Penning-Rowsell, et. all, 2020).

3. Research methodology

Damage functions, also referred to as vulnerability curves, are mathematical relationships that link flood parameters—such as water depth, duration, and velocity—to the percentage of damage sustained by various assets (Scawthorn, C., et. all, 2006) These functions are critical in quantifying the direct and indirect impacts of flooding. In Romania, damage functions are developed and adapted to reflect local conditions, incorporating detailed exposure data and typologies of buildings and infrastructure specific to the Romanian context.

These functions are derived from a combination of national and international data sources such as MCM (UK), HAZUS (USA), SSM (NL), including architectural datasets, construction cost records, and empirical observations from past flood events. These curves are designed to reflect the incremental increase in damage as water levels rise, enabling precise calculations of direct tangible damages. This localized approach ensures that the damage assessment is accurate and relevant to the socio-economic characteristics of Romania.

A critical metric in flood risk modeling is the *Expected Annual Damage* (EAD), which quantifies the average annual economic losses due to flooding. The EAD is calculated by integrating damage estimates over all potential flood scenarios, considering their respective probabilities of occurrence. This metric is vital for comparing flood risks across different areas and evaluating the cost-effectiveness of proposed mitigation measures. The expected annual damage is computed using the following formula:

$$EAD = \sum_{i=1}^N \Delta P_i \times D_i$$

where: ΔP_i is the exceedance Probability increment and D_i is the average damage of the two events with exceedance probabilities P_i and P_{i+1} (World Bank, 2021).

In Romania, the EAD is determined using a combination of hazard maps, exposure data, and damage functions. Hazard maps provide details on flood extents and depths for various return periods, while damage functions estimate the potential losses for different asset types at each flood depth. By summing the expected damages for all return periods, weighted by their likelihood, the EAD offers a comprehensive view of annual flood risks. This approach helps prioritize interventions, such as flood defenses, land-use planning, and emergency preparedness strategies, ensuring that resources are allocated efficiently. Furthermore, the EAD serves as a key input for cost-benefit analyses, enabling decision-makers to justify investments in flood risk reduction based on their long-term economic impact. This metric thus bridges the gap between technical flood assessments and actionable policy development.

4. Findings

The Dâmbu River basin has experienced frequent flooding, with significant impacts on local communities (Aquaproiect, EPMC, DHI, 2020, Options Analysis). Using the outlined methodology, the flood risk assessment for this area involved:

- **Data Collection:** Hydrological data on historical flood events, exposure data from land-use maps, and vulnerability data specific to Romanian settings.
- **Damage Modeling:** Applying damage functions to categorize and quantify potential damages across the basin. The model identified hotspots, including densely populated urban areas and critical infrastructure corridors.
- **Risk Mapping:** Generating flood risk maps highlighting zones with the highest expected annual damage (EAD). These maps are instrumental in prioritizing flood mitigation measures, such as dike construction or river channel improvements.

To be able to compute and map the flood risk, a set of hazard information is required. The hazard data available for the pilot studies is obtained from the hydrological/ hydrodynamic modelling activity for each pilot area, consisting of water depth and water velocity maps. The expected Annual Damage (EAD) was computed based on 5 return periods (10, 50, 100, 200, 500 years).

Results from the Dâmbu River case study revealed that residential buildings accounted for the largest share of direct tangible damages, followed by transportation infrastructure. Indirect damages were significant, especially in agricultural areas, where prolonged inundation disrupted planting and harvesting cycles (World Bank , 2020).

The study underscores the importance of localized damage functions in enhancing the accuracy of flood damage estimates.

Table no. 1 Risk assessment results for Dambu pilot area – EAD and 5 hazard scenarios (Mi euro)

	EAD	0.20%	0.50%	1%	5%	10%
Direct Tangible	13.7	286	230	181	129	77
Indirect Tangible	2.5	50	41	32	24	15
Direct Intangible	0.5	16	9	8	4	2
Indirect Intangible	0.1	1.3	1.2	1	0.7	0.3
Total Damage	16.8	253	281	222	158	95

Source: (World Bank, 2020)

By tailoring damage curves to specific local contexts (World Bank, 2020), such as incorporating unique building materials and structural designs observed in the Dâmbu River basin, the modeling process achieved a higher level of reliability. This adaptation ensures that results are reflective of the actual vulnerabilities within the region.

Additionally, the use of comprehensive vulnerability typologies that account for land use, infrastructure (World Bank, 2021), and population distribution proved crucial in producing detailed and nuanced risk assessments. This methodology enabled the identification of critical vulnerabilities in the Dâmbu River basin, highlighting areas most susceptible to flood impacts and requiring focused attention.

The integration of risk maps, derived from the damage and loss models, provided policymakers with actionable insights. These maps effectively highlighted priority areas for flood mitigation interventions, such as floodplain restoration or the enhancement of drainage systems, ensuring that resources were directed to where they could yield the greatest benefits.

However, several challenges remain. The limited availability of high-resolution exposure and vulnerability data poses a significant constraint. Expanding national databases and utilizing advanced remote sensing technologies can help overcome this limitation, improving the comprehensiveness of future assessments. Additionally, the inherent uncertainties in flood damage modeling, particularly concerning indirect damage estimation, necessitate improvements in data quality and the adoption of probabilistic approaches to better manage these uncertainties.

Finally, the success of flood risk management depends heavily on collaboration among stakeholders, including government agencies, local communities, and international organizations. Transparent communication of risk assessments and mitigation plans is essential to foster stakeholder engagement and ensure the effective implementation of flood resilience strategies.

5. Conclusions

The Dâmbu River case study demonstrates the practical effectiveness of damage, loss, and risk modeling in addressing the complex challenges posed by flooding in vulnerable areas. By leveraging localized data, tailored damage functions, and detailed typologies of vulnerable elements, the methodology produces highly specific risk assessments that reflect the unique socio-economic and geographic characteristics of the region. This localized approach ensures that the outcomes are not only accurate but also actionable, allowing policymakers to prioritize mitigation strategies in high-risk areas effectively.

Beyond its application in the Dâmbu River basin, the broader methodology developed for flood risk assessment in Romania provides a versatile and robust framework. The integration of hazard mapping, exposure data, and vulnerability curves tailored to local contexts enables a comprehensive understanding of flood risks. The methodology's focus on Expected Annual Damage (EAD) as a key metric further enhances its utility by facilitating comparative risk evaluations and justifying

investments in flood protection through cost-benefit analyses.

Moreover, the classification of damages into direct tangible, indirect tangible, direct intangible, and indirect intangible categories ensures that the full spectrum of flood impacts is accounted for. This nuanced approach allows for a more holistic understanding of flood consequences, including physical destruction, economic disruptions, and societal effects such as psychological trauma and reduced trust.

The findings emphasize the importance of integrating such sophisticated methodologies into national and regional flood management plans. By adopting these tools, Romania can enhance its resilience to flooding, minimize socio-economic losses, and ensure that resources are allocated efficiently. This framework aligns with the requirements of the EU Flood Directive and serves as a model for other flood-prone countries aiming to improve their risk assessment and mitigation strategies. In sum, the methodology not only offers a scientific and systematic approach to flood risk assessment but also bridges the gap between technical analysis and practical policy implementation.

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Challenges Facing the Wood Trade in Europe

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Abstract

In this study we will focus on the analysis of the wood trade at global, European and national level (Romania), in order to identify both the demand and supply, as well as the challenges facing this market.

Sustainable management of forest resources is essential to ensure a continued and beneficial role of wood in economic development.

Further action is needed at European and governmental level to support producers and ensure a balance between economic needs and the sustainable conservation of forest resources on the European continent.

Key words: wood, trade, European Union

J.E.L. classification: K32, O13, O25, Q01

1. Introduction

The importance of this topic is given by the fact that the European wood trade is a complex area with multiple aspects to be addressed: resources, regulations, trade, demand, impact, economics.

Excessive exploitation of forest resources can have significant environmental impacts, contributing to deforestation, biodiversity loss and climate change. By adopting sustainable practices, it seeks to manage forest resources in a balanced and responsible way.

The aim of the paper is to present the wood trade in Europe, which is the world's leading timber producer. Also to emphasize Northern European exporters who play a vital role as suppliers of forest products. We will also present the main importing countries.

Also, we will focus on Romania, one of the European countries with an important role in the wood market, a competitive industry with an important contribution to GDP, which supports more than 150,000 jobs in this country.

2. Literature review

There are few scientific papers analyzing the timber trade at the European level, most of them being analyses made by international organizations.

One of the most important is this study by Eurostat, available online: "Agriculture, forestry and fishery statistics", which contains data on the production, export and import of wood products in the European Union. It gives us recent analysis of the European timber market. Another source is World Bank, WITS: "European Union Wood Imports by country 2022".

At the global level, we have several specialized studies, including Zarah Hamid, 2023, „Top 20 Largest Timber Exporting Countries in the World”.

Regarding European Union, a recent study is “How much wood can we expect from European forests in the near future?” (Zarah, 2023). One of the research findings of this paper is that when regional characteristics are taken into account, they are determinant for forecasting future harvests, with a direct impact on the potential of wood production (i.e. export). Another conclusion of the above-mentioned study is that an important part of the timber potential is privately owned, which is less well known and quite surprising.

Eurostat analyzed "Roundwood removals by type of wood and assortment" in all European countries, between 2018-2024.

For the Romanian wood market, we analyzed the report ASFOR (Romanian Foresters Association): „World timber market in October. Europe is banking on timber construction”, 2024.

Another study considered was "Challenges in Forestry and Forest Engineering – Case Studies from Four Countries in East Europe". The analysis focused on four countries: Romania, Croatia, Poland and Latvia. In all these countries, the state-owned forest sector was at least 45%. Environmental issues were also identified as challenging factors.

3. Research methodology

In order to analyze the evolution of the timber trade at the European level, we have chosen the quantitative analysis, as it is the most appropriate to compare the results obtained in the same figure.

In terms of research, comparative analysis is very attractive because we have the possibility to measure not only the properties, but also the realities between them.

The main source for world timber trade data was Eurostat. In addition to this, we analyzed other specialized reports, as can be seen below.

4. Findings

4.1. Brief analysis on the global wood trade

The world timber trade is a significant part of the global economy, with impacts on the environment, society and industry.

Major exporting countries include Canada, the United States, Russia, Brazil, and South-East Asian countries such as Indonesia and Malaysia. Major importers include China, the United States, Japan, India and European countries.

The timber trade covers a variety of products such as sawn timber, planks, veneer, paper and board, furniture, as well as engineered wood products such as flooring, windows and doors.

China tops this ranking with an impressive \$8.8 billion worth of imports in 2022. As the world's largest consumer of roundwood, China's demand is driven by its booming timber industry, which uses wood for construction, furniture and packaging. The country's vast manufacturing sector, combined with its growing middle class, has fueled demand for wood products, making it an attractive market for roundwood exporters.

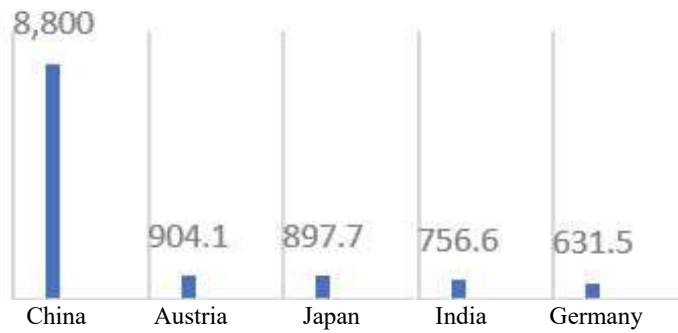
Austria ranks second with an import value of \$904.1 million in 2022. Despite being a small landlocked country, Austria has a strong forestry sector that relies heavily on imported roundwood to meet its demand. In addition, the country boasts a well-developed wood-processing industry, which uses roundwood as a raw material for furniture, flooring and wooden structures.

Reaching the value of of \$897.7 million in 2022, Japan ranks third. Japan's wood market is primarily driven by the construction industry, where wood is widely used for residential and commercial buildings. In addition, the nation's cultural affinity for wood-based products, such as traditional Shoji screens and Tatami mats, further contributes to the demand for round timber.

India ranks fourth with an import value of \$756.6 million in 2022. The country's rapid industrialization, population growth and urbanization have given rise to a surge in infrastructure development, thereby increasing the demand for roundwood. Moreover, India's furniture industry has experienced a significant boom, leading to a greater need for wood resources.

Germany ranks fifth with an import value of \$631.5 million in 2022. Despite being renowned for its timber production, Germany still relies on roundwood imports to supplement its domestic supply. The country's thriving construction sector, coupled with demand for wooden furniture, has fueled its import market for roundwood. (INDEX BOX, 2024)

Figure no. 1 Main roundwood importing countries in 2022



Source: Author's contribution

4.2. Features on the European wood trade

Europe is the leading producer of timber. Green building codes are followed here, so wood is a sustainable option for buildings, lowering the carbon footprint.

In 2021, the European Union's main timber trading partners were the United States, Switzerland, the United Kingdom, China and Norway for exports and China, the Russian Federation, the United States, Brazil and the United Kingdom for imports.

Global demand for forest products, including sawnwood, panels, pellets, pulp and paper is growing, and the forest industry in Northern Europe plays a vital role as a supplier of forest products to the rest of Europe and markets in Asia, the USA, Africa and the Middle East. The Nordic countries account for about 16% of the world's exported softwood timber, 16% of exported paper products and 14% of exported wood pulp (higher share of softwood pulp).

Germany remained in first place in 2022, as the main producer of roundwood (79 million cubic meters), and in 2nd and 3rd place were Sweden and Finland (with a production that fell between 66 and 77 million cubic meters).

Figure no. 2: Roundwood production, 2022 (1000 m³)

Total production	
Germany	78.872
Sweden	77.200
Finland	65.637
France	53.139
Poland	45.693
Czech Republic	32.586
Austria	19.358
Spain	17.921
Romania	17.476
Latvia	15.427

Source: Author's contribution, based on data provided by Eurostat, 2024

Traditionally, conifers have always been the most important component of roundwood, with a share of around 69% in most member countries. Although conifer roundwood production shows minor fluctuations, non-conifer roundwood production has been constant over the last 20 years.

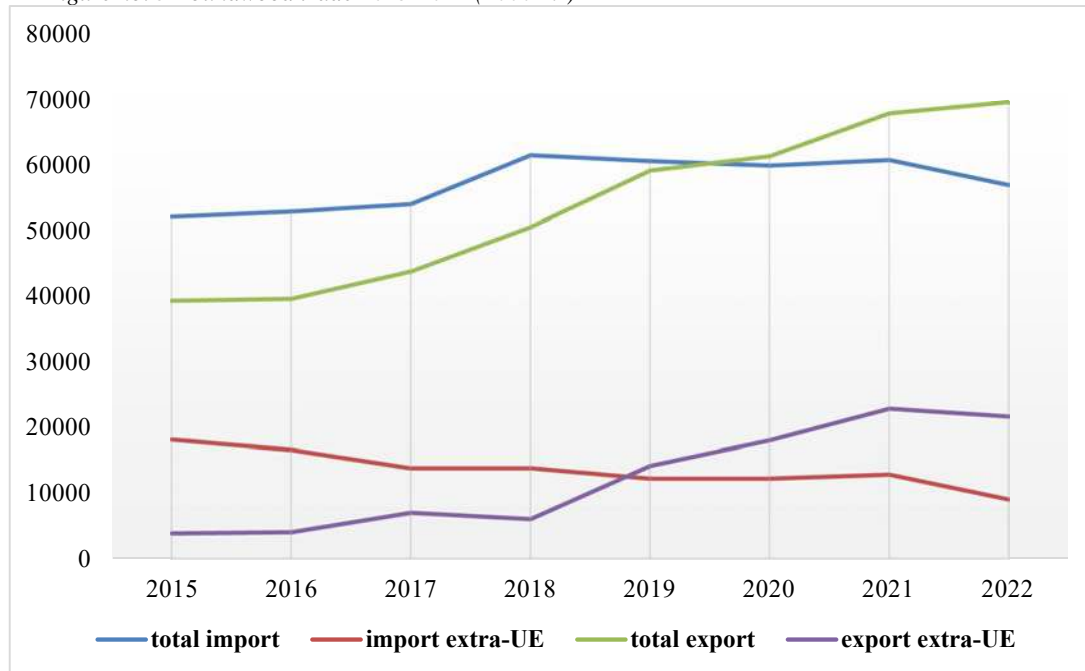
Imports during the analyzed period have slightly increased from 52,071 thousand cubic meters of imported quantity in 2015 to 56,880 thousand cubic meters of imported quantity in 2022.

Exports also showed an upward trend, with European countries exporting 39,288 thousand cubic meters of roundwood in 2015 and 69,571 thousand cubic meters in 2022.

A downward trend had extra-EU imports, from about 18,000 thousand m³ in 2015 to 9,000 thousand m³ in 2022. Extra-EU exports increased visibly over the period analyzed, from 3,840 thousand m³ (2015) to 21,567 thousand m³ (2022).

The European Union has been a net exporter of roundwood in recent years, with a value of 12.5 million m³ in 2022. In terms of destination, a quarter of production was used for as fuelwood and the remainder was used for lumber and veneer, pulp and paper production.

Figure no. 3 Roundwood trade 2015-2022 (1000 m³)

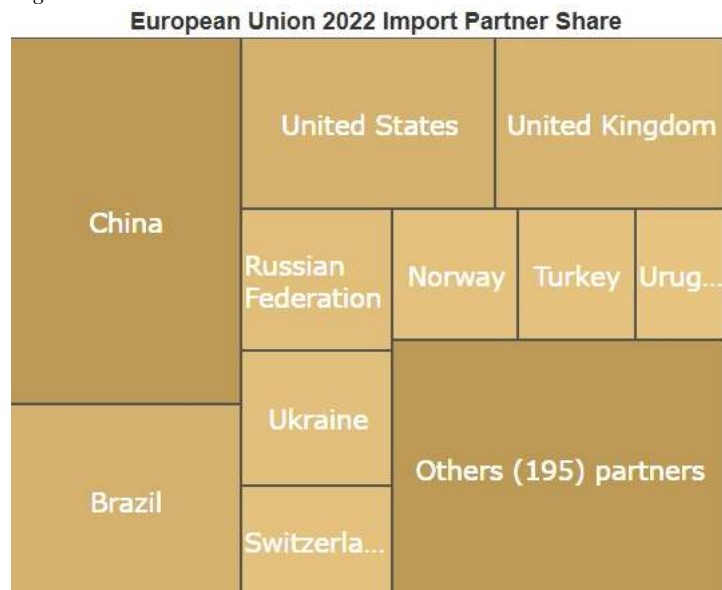


Source: Author's contribution, based on data provided by Eurostat, 2024

In the same year, trade in roundwood presents a net balance of 12 billion cubic meters. By analyzing the above graph, we can see the constant increase in total roundwood exports after 2016. the evolution was similar for exports outside the member countries. imports, however, had an opposite evolution, in the sense of their decrease since 2018, which led to the net surplus.

As regards the European Union's import and export partners in the wood trade in 2022, they can be represented as follows:

Figure no. 4



Source: (World Bank, 2022)

Figure no. 5



Source: (World Bank, 2022)

As it can be seen in the pictures above, China and Brazil are in the top two places for imports and the UK and the USA for exports.

4.3. Wood industry in Romania

The Romanian wood industry is a competitive industry, with a direct and induced contribution of 3.5% to Romania's GDP, a net positive annual contribution of 3.5 billion Euro to Romania's trade balance, which supports 150,000 jobs in Romania, most of them in rural communities.

The wood trade in Romania is an important and varied industry, with an impact in several sectors, including construction, furniture, paper industry, but also in other sectors.

Romania has a significant forested area, with approximately 27% of its territory covered by forests, according to 2020 data. These forest resources provide a solid basis for the wood industry. Romania is both a producer and a consumer of wood products. In general, the country exports a wide range of wood products, including timber, firewood, furniture, paper and cardboard, while at the same time importing various products such as wood panels, flooring, furniture and other items.

The furniture industry is one of the most important branches of the wood industry in our country. There are numerous factories and workshops producing furniture for both domestic and foreign markets. Exports of wooden furniture and furniture components are significant for the country's economy.

In 2021, the top partner countries to which Romania exports timber include Italy, the United States, China, Japan and Germany. In the year 2022, Romania's exports of sawn timber to Sweden amounted to 18.73 thousand USD.

The total contribution of the forest sector and wood-based industries amounted to € 9.86 billion annually, taking into account both the direct impact, which has steadily increased over the last five years, and the indirect and induced effects. The direct contribution of forestry and wood-based industries was 1.6% of GDP in 2020, while the total impact of economic activities, including indirect and induced effects, is much higher, reaching 4.5% of GDP.

According to European statistics, Romania harvests a commercial volume of 33% of the total annual growth of forests, while the European average is around 63% and the top three countries harvest close to or even above 100%. Total timber production, at only 2.3 cubic meters of commercial roundwood per hectare, is among the lowest in Europe. Countries with similar conditions to Romania have a much higher harvest rate (Poland 4.6 mc/year/ha, Austria 4.9 mc/year/ha, Germany 6.8 mc/year/ha).

Around a third of the wood harvested is used as fuel for heating, making Romania one of the world's biggest consumers of firewood for heating, surpassed only by France among countries with a higher production than Romania.

In 2017, Romania exported 884,000 cubic meters of OSB, in 2021, the exported quantity will reach only 779,000 cubic meters, which represents a 12% decrease. The export of sawn hardwood lumber also saw a downward trend, from 642,000 cu m in 2017 to 534,000 cu m in 2021.

In 2021, our country exported \$524m worth of sawn softwood lumber, \$245m worth of sawn hardwood lumber and \$287m worth of OSB.

Romania's wood industry is now going through a crisis, reflected in a fall in production, closures of production capacity and layoffs. According to the NSI, the drop in production in 2023 was 24% in the timber industry and 13% in the furniture industry, and this trend will continue in 2024, in the absence of an appropriate action plan.

5. Conclusions

Within the dynamic and complex framework of the year 2024, analyzing the timber market becomes essential for understanding the challenges and opportunities facing the forest industry. As far as Europe is concerned, the forest sector is at a crossroads, with declining sales and export challenges, but also promising opportunities in the area of timber construction.

Industrial processing generates pollution and nuisances, and the wood industry, like industries in other sectors, generates emissions of various types of pollutants during the various stages of machining and processing of wood materials, which are released into the natural environment in solid form (various types of waste), liquid form (chemicals with polluting properties) and gaseous form (solvents and various more or less dangerous gases). This industrial sector is also faced with increasing environmental pressure, mainly from people living near its facilities, but also from public opinion in general. Certain rules currently apply to manufacturing sites, while others will eventually apply to wood sector products, which will have to comply with certain environmental criteria laid down by the various regulations aimed at harmonising industrial activity with the need to protect the environment.

Illegal and unsustainable logging is a major concern in the timber trade. International organizations and countries have taken action to promote sustainable practices and combat illegal logging.

Many governments have enacted regulations governing the marketing of timber and timber products, such as in the United States (Lacey Act), Australia (Illegal Logging Prohibition Bill) and the European Union (EU; Timber Regulation [TBR]). The EU Timber Regulation (EUTR) is a key element in the efforts of the European Union to curb the trade in illegal timber products (Rougieux, Jonsson, 2021). These acts require products to be checked with all due diligence before being placed on the market.

As in other countries, sustainable management of forest resources and combating illegal deforestation are major concerns in Romania. The authorities and non-governmental organizations are working to promote responsible logging practices and to impose stricter regulations to protect the environment.

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Global Trends and Economic Implications of Quantum Communication Technology

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Abstract

Quantum communication technology is emerging as a transformative area in telecommunications, with the potential to revolutionize how data is transmitted, secured, and processed globally. The global quantum computing and communication market is expected to grow rapidly as major technology firms are contributing to the development of quantum communication hardware and software, signaling the commercial potential of such technology.

This paper presents a comparative study of quantum communication across different regions (China, the United States, and the European Union). The result indicates distinct approaches, technological advancements, and strategic goals.

Key words: China's Quantum Science Satellite Project, the EU Quantum Flagship and U.S. National Quantum Initiative

J.E.L. classification: 014, 031, 032, 033, Q55

1. Introduction

Quantum information science and technologies are expected to revolutionize the economy by creating entirely new markets, industries, and business models.

Quantum information science is a multidisciplinary field at the intersection of quantum mechanics, information theory, and computation. Its aim is to combine principles of quantum mechanics with information theory to revolutionize computation, communication, and sensing. The societal and economic roles of quantum technologies are profound, influencing diverse sectors by enabling technologies that were previously considered unattainable.

Quantum communication is a subfield of quantum information science that leverages the principles of quantum mechanics—particularly quantum entanglement and superposition—to enable secure and efficient transmission of information. Unlike classical communication systems that rely on electronic signals or electromagnetic waves, quantum communication uses quantum states, such as photons, as carriers of information. Quantum information science provides unparalleled security for digital communications. Quantum key distribution (QKD) ensures that sensitive data - such as personal, financial, or governmental information - remains secure in an era of increasing cyber threats and privacy concerns.

Beside enhancing data security, the societal role of quantum information science is reflected in advancing scientific knowledge for exploring the limits of physical laws and understanding complex systems, in revolutionizing healthcare, supporting education, workforce development and empowering sustainability and climate solutions.

The economic role of quantum information science and technologies is in creating new markets and industries (e.g. quantum computing services like cloud-based quantum computing platforms offered by companies like IBM, Google, and Microsoft or high-precision devices for medical diagnostics, navigation, and industrial applications), as well as in fostering innovation. For

example, quantum-enhanced materials and processes in manufacturing can improve efficiency and product quality. Quantum algorithms can optimize supply chain management and transportation networks in logistics.

As quantum computers evolve, they pose a risk to current encryption standards, threatening global cybersecurity. Investing in quantum-safe cryptography ensures economic stability by pre-empting potential disruptions

The concept of quantum communication first gained significant traction in the early 1980s, with the seminal work of Stephen Wiesner and Charles H. Bennett. Wiesner's idea of "quantum money" (concept evolved since 1972, but was first published in 1983) introduced the potential of quantum states for secure applications. The concept uses the rules of quantum physics to create money that cannot be copied or faked. Such concept can be compared with embedding an unbreakable code into each note, for security reasons. While there is no technology to implement quantum money widely yet, the idea laid the groundwork for quantum cryptography, which is now a booming field in secure communications.

This was followed by Bennett and Gilles Brassard's (1984) publication of the BB84 protocol, which became the foundation of quantum key distribution. The protocol represents a method for securely sharing encryption keys using quantum mechanics. In economics, secure communication can be viewed as a problem of transaction costs and trust: insecure communication channels increase the cost of doing business (e.g., losses due to fraud or theft) and parties need to trust intermediaries (banks, governments, or third-party networks) to securely transfer sensitive information, which can introduce vulnerabilities. BB84 protocol addresses this by offering a way to share encryption keys securely, eliminating the need for trust in intermediaries and drastically reducing the risk of eavesdropping („fraud" in the communication market). The principles of BB84 could extend to secure financial transactions, digital currencies, and even smart contracts, where quantum-secure protocols prevent tampering or fraud. Such developments marked the beginning of practical quantum communication research.

2. Research methodology

The objective of this paper is to bring an economic approach to global quantum communication advancements. The methodology consists in delivering a regional comparative analysis carried taking into account three criteria of analysis: quantum communication initiatives, strategies, and advancements in three major developed regions of the globe: China, the United States, and the European Union. The data used for the regional analysis consist in secondary data published online by the international media and international institutions.

3. Literature review

There is a potential of quantum communication to enhance national defense and economic development (Yu, 2004) and in space satellite-based communication as a means to secure global information exchange (Schiavon, 2017). Quantum technologies have a relevant role in future digital economies and communication networks (Manzalini, 2020) and can address challenges in computation and communication, impacting the digital economy (Manzalini, 2021). Overall, they can revolutionize computation, communication, and economic growth (Wang, 2012).

The impact of quantum technologies on innovation processes in the global economy was analysed, including how quantum technologies could drive innovation and economic competitiveness, by Korzh (2024) while the economic implications of quantum communication as a core networking technology were approached by Sridhar et al. (2023)

According to Chehimi & Saad (2022), quantum communication networks can be integrated in future economic and technological systems, and they provide relevant implications for economics and financial systems (Hull et al., 2020).

Quantum communication's role in secure information exchange and societal benefits were approached by (Verma, 2013) and Ratkin had explored the economic implications of quantum communication and cryptography, proposing the term *quantonomics* - economy of quantum computers and quantum communication (Ratkin, 2021). The challenges and opportunities in

quantum communication for economic applications were approached by Chen (2021).

4. Findings

4.1. China, US and European Union's public and private investments in quantum technologies

Quantum information science has become a focal point for public and private investment. Governmental programs like the, China's Quantum Science Satellite Project, the EU Quantum Flagship and U.S. National Quantum Initiative are channeling billions into research and development. Also, technology giants and startups in the private sector are competing to commercialize quantum technologies, fueling innovation and economic activity.

China has made significant progress in quantum information science, with the Micius quantum satellite experiments and a 987 million USD research funding effort, and is poised for future advancements (Ciang Zhang et al., 2019). Quantum Science Satellite is one of the first five space science missions, slated for launch in the framework of Chinese Academy of Sciences(CAS) Strategic Priority Research Program on space science. The project aims to establish a space platform with long-distance satellite and ground quantum channel, and carry out a series of tests about fundamental quantum principles and protocols in space-based large scale. (Jianwei, 2014). The Micius satellite effectively obtained ultralong-distance global quantum network, enabling secure communication between China and Europe at locations separated by 7600 km on Earth and pointing towards an efficient solution for an ultralong-distance global quantum network. (Liao, 2018).

The U.S. National Quantum Initiative (NQI) established through the National Quantum Initiative Act of 2018, aims to advance quantum information science and its applications. The initiative aimed to maintain U.S. leadership in quantum technologies through establishing multidisciplinary research centers, funding for quantum research through agencies like the National Science Foundation, Department of Energy, and National Institute of Standards and Technology (NIST), and by promoting workforce development and commercialization of quantum technologies. The Quantum Economic Development Consortium (QED-C) is an industry-driven consortium supported by NIST and more than 185 corporations, universities and other organizations to enable and grow the quantum industry and supply chain. (Merzbacher, 2020) showing that the US National Quantum Initiative Act of 2018 promotes effectively quantum information science and innovation, with a focus on economic benefits and industry growth.

Similar to China and the US, quantum technologies investments in Europe have a recent history. Since the first quantum revolution in the early twentieth century, a whole range of applications in the field of scientific research and societal application has emerged: laser, electronics, satellite-based positioning, medical imagery, etc. (EU Space). According to the European Commission, "developing and deploying a Quantum Communication Infrastructure (QCI) with a terrestrial and space segment represents one of the priorities towards which the European Commission is working on, to project Europe into the quantum era". The European Quantum Communication Infrastructure (EuroQCI) initiative is a strategic effort by the European Union to develop and implement advanced quantum communication technologies. Its primary goal is to establish a highly secure, quantum-encrypted communication network that connects government institutions and critical infrastructures across the EU. It was designed for developing quantum technologies and ultra-secure communication. The initiative is intended to advance the development of quantum technologies to make them operationally reliable and robust for practical use and to perform space qualification, ensuring these technologies can function effectively in space environments.

EuroQCI initiative represents a pivotal step toward establishing a secure, resilient, and advanced communication network based on quantum technologies. It aims to enhance Europe's cybersecurity, technological leadership, and digital sovereignty while fostering innovation and industrial growth.

The initial steps within the EuroQCI initiative consisted in the establishment of the first quantum network linking three different countries by the cities of Trieste in Italy, Rijeka in Croatia, and Ljubljana in Slovenia (Ribezzo et al, 2024).

In 2016, the European Commission was preparing for the launch in 2018 of a €1 billion flagship initiative on quantum technologies, suggestively named "the second quantum revolution", envisioning technological advancements in science, industry and society (EC, 2016) like satellite-based services as well as the EU space programmes to improve the daily life and security of citizens. The grants were planned for European research in "quantum secure communication, quantum sensing and quantum simulation and computing into concrete technological opportunities that can be taken up by industry" (EC, 2016).

It is expected that in less than 10 years, the second quantum revolution will have a significant impact over numerous industries, including finance, medicine, energy, transportation, etc. (Farrugia et al, 2024).

4.2. Global trends and economic implications

As costs decrease and accessibility improves, quantum technologies will become available to smaller businesses and developing nations, reducing economic disparities and fostering global innovation. Quantum technologies are expected to disrupt industries reliant on classical computing by offering superior solutions for complex problems. This shift necessitates adaptation and re-skilling in sectors like finance, logistics, and healthcare.

Nations are racing to achieve quantum supremacy, recognizing its strategic and economic importance. Simultaneously, international collaborations are fostering shared progress, as seen in initiatives like the Quantum Internet Alliance.

Such global trend is expected to generate millions of high-paying jobs in fields like quantum engineering, software development, and cryptography. The ripple effects will stimulate growth across related industries.

China's advancements are highlighted by the Micius satellite and its successful demonstration of ultralong-distance quantum communication. The country has also established a 2,000-km quantum communication backbone linking Beijing and Shanghai. These achievements position China as a leader in space-based quantum communication and practical applications of quantum networks. With such satellite experiment, China's strategy emphasizes state-led investments and rapid deployment of large-scale quantum projects. By focusing on space-based quantum communication, China seeks to achieve technological sovereignty and secure communication capabilities, ensuring strategic advantages in cybersecurity and military applications. Collaboration with European institutions through experiments like Micius reflects a blend of competition and cooperation. China is poised to secure economic benefits through secure communication networks and exportable quantum technologies, by achieving technological sovereignty in quantum communication, potentially dominating the global market.

The U.S. strategy revolves around fostering a robust quantum ecosystem through public-private partnerships and industry-driven initiatives. The NQI ensures a balance between fundamental research and commercialization, with significant investment in workforce development to address the talent gap in quantum technologies. The U.S. approach prioritizes scalability and integration of quantum solutions into existing technological and economic frameworks. The U.S. leads in quantum computing and private-sector innovation, with companies like IBM, Google, and Microsoft achieving milestones in quantum supremacy and error correction. The NQI has catalyzed advancements in quantum sensing and simulation, with applications spanning medicine, finance, and national security. Initiatives like QED-C are driving the standardization and commercialization of quantum technologies. The U.S. focus on commercialization and public-private collaboration positions it as a hub for quantum startups and industry innovation, with economic impacts spanning multiple sectors, including defense and finance.

The EU's strategy is rooted in fostering digital sovereignty and enhancing cybersecurity through quantum technologies. By integrating quantum communication into existing space programs and creating a unified European infrastructure, the EU aims to consolidate its technological capabilities and ensure resilience against cyber threats. The EuroQCI initiative reflects a commitment to

industrial growth and the operational reliability of quantum technologies. The EU has made significant progress in developing a secure quantum communication infrastructure. The EuroQCI initiative has established the first multinational quantum network and aims to integrate terrestrial and space segments. The EU Quantum Flagship has fostered advancements in quantum simulation and sensing, with applications expected to transform industries like transportation, energy, and healthcare within the next decade. The EU's emphasis on digital sovereignty and cybersecurity aligns with its economic strategy of fostering innovation while ensuring resilience against cyber threats. The integration of quantum technologies into space programs could yield significant economic returns through enhanced satellite-based services.

5. Conclusions

Quantum information science is a transformative force with far-reaching implications for society and the economy. It offers unprecedented opportunities to enhance security, solve complex problems, and drive innovation across industries. However, its potential can only be fully realized through strategic investment, international collaboration, and a commitment to ethical development. As quantum technologies continue to evolve, it will undoubtedly shape the technological and economic landscape of the 21st century.

Quantum communication addresses critical needs for secure data transmission in finance, defense, and healthcare. The rise in publications corresponds with national quantum initiatives (e.g., China's quantum satellite Micius, the EU Quantum Flagship, and the US National Quantum Initiative), underscoring the strategic importance of the field.

China, the U.S., and the EU each exhibit distinct approaches to quantum communication, reflecting their geopolitical and economic priorities. While China excels in state-led, large-scale quantum initiatives, the U.S. focuses on commercialization and industry growth, and the EU prioritizes cybersecurity and digital sovereignty. Together, these efforts are driving a global quantum revolution with transformative economic implications.

6. Acknowledgment

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Approaching the Concept of E-Government in the Romanian Public Sector in Terms of the Degree of Digitization

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Abstract

The paper addresses both the topic of digitalization for the Romanian public sector and the degree of technological performance achieved by public institutions, developing at the same time a quantitative and qualitative analysis of these services. Starting from the legal framework, the form of organization and the general concepts of E-Government in the public services market, while analyzing their evolution, we presented minimalist and succinctly the progress in stages of the digital sphere, presenting at the end of the paper a thorough analysis of this field.

Key words: public service, decision, local public institution

J.E.L. classification: G30, G38

1. Introduction

Public administration is the institutional basis for how countries are governed. This entity engulfs and fulfils all the requirements of society, thus operates according to its key parameters (specific processes, continuously improving policies, built-in specific programs, etc.). All this, together with other external factors and conscious efforts of public institutions, have consistently contributed to boosting the performance of administrations.

Public administration has a considerable influence on social trust and determines the factors for creating and measuring their administrative value. The current pace of social, technological and economic change requires public administrations to adapt to new realities (Ayanso, Chatterjee and Cho, 2011).

This reform of public and governmental institutions, together with the provision of improved services to citizens, has long been recognized as a major criterion for development, and ongoing efforts directed towards e-governance can be seen as one of the main goals in the evolution of the entire world.

Although the term e-government is primarily used to refer to the use of digital technologies to improve administrative efficiency, it may turn out that it produces other effects that could give rise to increased transparency and accountability of government processes.

Both socially, economically and technologically, the organizations and institutions in Romania carry out their activity, at the border between the technological field with a transformative role and the society, hereinafter referred to as human capital, which still manifests a high degree of reluctance and mistrust.

The transformations referred to concern both tangible resources and the intangible area, namely rules, legislative norms, working mode, sometimes even organizational structures and models. Thus, all these changes are generated and maintained by technologies at different stages of development and implementation.

The phenomenon of digitalization has gone through several stages globally over time, and currently we can say that its presence is found in almost all aspects of life.

At the end of 2021, the European Commission developed a study on member states on public and government services and the degree of digitization of processes existing in the territories of the 27 countries. There have been tested official websites of national institutions, the emphasis being placed in accordance with 4 important criteria: ease of access, transparency, transparency, serving across borders and focusing efforts on so-called "end customers" – service recipients.

According to the index of the digital economy and society (DESI), Romania ranks last in the ranking of the 27 EU member states. As shown in Figure 2, Romania scored below average for most indicators. In Romania, the performance of the digital sector is mainly characterized by the DESI. (The Digital Economy and Society Index (DESI), available online at: <https://digital-strategy.ec.europa.eu/en/policies/desi>).

2. Theoretical background

From a European average of 68% obtained on a scale of 0%-100% regarding the percentage of maturation of digital public services, Romania obtained a score of 40% which denotes that our country has not made notable progress compared to other countries.

Considering that the study mainly followed the interaction between citizens and public institutions exclusively through the Internet network, we can conclude that this degree of use of these digital services will not lead to the migration of citizens from non-digitalized classical public services to digital public services soon. (Andrews, Thornton, Owen, Bleasdale, Freeguard, & Stelk, 2017).

The digitalization of public administration means more than creating a simple virtual space meant to replace classical public services with completely digital ones. Other highly impactful invoices are also involved in this process, such as: transparency, cost efficiency and reduction of response times.

E-Government engulfs two key components: one refers to information concepts and the second refers to all technologies regarding communication aspects. These two components support and develop the area of public services, government administrations, democratic processes, as well as relations / interactions of three major entities: the first entity is represented by the citizens of society, the second entity is represented by the micro / macro private sector and the third entity represents state specific institutions (Sheridan and Riley, 2006).

This concept has been developed over more than two decades of technological innovation and political response. The evolution of e-government will be examined in this paper around five interdependent objectives: the policy framework, improved public services, the government operations, involve citizens in this process, effective processes and administrative and institutional reform.

This summary evaluation of e-government in democratic states and local governments will show that the largest investments and progress have been made in improving public services and improving government operations. The development of these policies has progressed on several fronts, while new political and technological issues have been added in direct proportion to the extent of evolution. The slightest progress seems to have taken place in strengthening democracy and exploring the implications of e-government for administrative and institutional reform. Governance based on digital systems will continue to evolve in the foreseeable future, providing a dynamic environment for continuous learning and action.

UNESCO describes E-Government as a combination of using information-based updated technologies with the latest communication tools and technologies, with the goal of obtaining an improved provision of information and / or services, to mitigate for citizen involvement in all decision-making processes. In this way, the government will be more accountable for its actions, more transparent in decision-making and a more effective state institution.

Also, E-Government engulfs improved leadership patterns, more efficient and transparent debating techniques, improved decision-making policies, smarter and more efficient investments, updated state-of-the-art education access, etc.

E-government is much more than a simple word or entity compared to classical governance, because it produces a change in government-citizens interactions. Thus, various new approaches regarding citizenship are being put into action, like the needs of society (its people) and its responsibility level.

It is objective is to involve, unite and empower the relationship between citizens and government. Accessing public services in a digital manner from a distance aims to increase the accessibility of public administration by a wide range of clients, like people with various mobility disabilities or other disabilities that could impede computer use.

Considering the latest status of policy improvement in regard with digitalization conditions, there are some challenges regarding some gaps / imperfections of the legal support in tackling specific problems aimed at fixing (fine tuning) the development final purposes of the digital economy.

Fixing a specific problem could be achieved by presenting the key process components of digitalization in state programs. It is mandatory to correctly identify and integrate adequate information and a specific analytical mechanism (tools) to tackle addressing accessibility issues as they emerge, as well as all sensitive transparency challenges.

E-government is a broader concept that deals with the entire spectrum of government relations and networks regarding the application techniques and usage ways of ICT, while e-government displays its limitations in development of online services. Other research would describe e-government and classical governance as completely heterogeneous / different entities (Ayanso, Chatterjee and Cho, 2011).

E-Government is a wider term that encompasses a series of well-established relationships and networks between government and society (Sheridan and Riley, 2006). Being a more controlled area in association with constant updating of online specific services for people (of society), it inflicts an increased level of awareness on government services (e-taxes, e-education, e-health).

E-Government represents a complex concept that describes the implications of modern up-to-date technology on governance approaches, takes to a higher level both the interactions between government and society (its people), and the interactions between Non-Governmental Organizations and private sector actors (Sheridan and Riley, 2006). The so-called "E-Romania" is a program of the Romanian government that aims to computerize and interconnect several public service systems.

The aim of the program is to simplify administrative procedures and reduce red tape. These also provide for the reduction of the costs of public administration and the efficiency of the governance act. The government approximates an expenditure of about 1.2 billion euros for the development of the project.

The future of society, democracy and government is digital. The digitalization of the public service should be seen as a key strategic objective for sustainable development. The results mentioned in this chapter have direct implications for policies and reforms in public administration, both worldwide and at national level.

Starting with the global analysis, by restricting statistics at European level and later at national level, a comparison was made between states. It has been demonstrated that the digitization of public administration is one of the most effective ways to reduce costs, corruption and increased efficiency in the public sector. This conclusion underlines that state administrations should develop and implement appropriate strategies and policies for integrating large-scale digital applications. The research results demonstrate that the digital transformation of public administration in EU countries continues to be influenced by a lot of factors: economic, administrative, managerial-strategic and political (Almarabeh, Majdalawi and Mohammad, 2016).

3. Research methodology

The main objective of this paper is to establish citizens' perceptions on the degree of innovation, digitalization of public services and how they are perceived among citizens. The questionnaire was applied using Google Forms. It has been distributed in various social media groups. At the time of distribution, it was mentioned that the respondent must have experienced at least once the online services provided by the Romanian public institutions. This aspect was later

highlighted from the first question of the questionnaire, thus aiming to obtain as many valid and real results as possible.

The proposed questionnaire has 3 segments: customer expectations, customer perceptions and demographics, containing a total of 15 elements, divided as follows: 7 elements for the perception part, 8 elements for the expectations part and 5 elements for the demographic data. The applied E-S-QUAL model is also considered more effective because the size of the questionnaire applied is halved compared to the SERVQUAL model, thus providing more accurate answers. In the case of a larger questionnaire, respondents tend to lose interest and provide superficial answers or even not finish the questionnaire.

This can justify the small number of questions (Souca, 2011). In turn, the expectations segment and the perception segment are divided into the 5 dimensions of the model, to facilitate our interpretation of the results and identification of gaps. The E-S-QUAL model, which was developed by Parasuraman and is the basis of this study, offers a more comprehensive approach as it supports the measurement of quality aspects both pre-and post e-service (Parasuraman, Zeitham and Malhotra, 2005).

Moreover, the dimensions of E-S-QUAL were developed by processing data provided by respondents who had previous experience. Therefore, compared to other studies that used comfort samples of students, the E-S-QUAL model has helped to provide more representative information on the quality of electronic services.

In this respect, in addition to the SERVQUA (Souca, 2011) model, the following four dimensions have also been included:

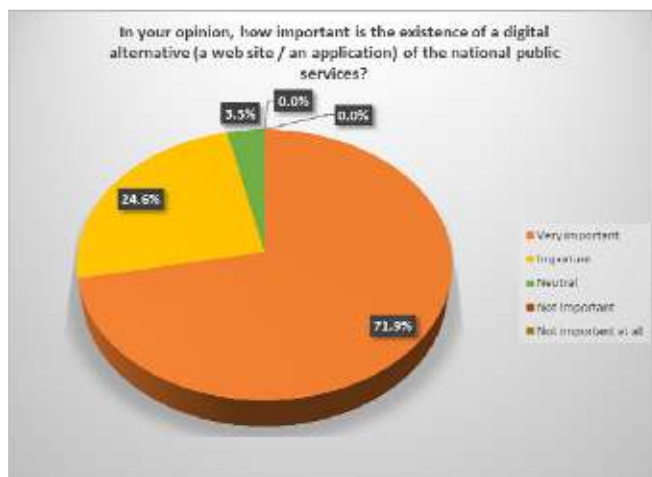
- the efficiency;
- involved;
- availability of the system;
- confidentiality.

This simplification of both questions and answers aims at the accuracy of the analysis. A series of simplified questions and answers leads to much easier and precise results, unlike a questionnaire with more complex questions and answers that could more easily mislead the respondent.

4. Findings

By opening the actual analysis of the results obtained, even from the first questions, some gratifying conclusions can be deduced. For example, at the 2nd question "*In your opinion, how important is the existence of a digital alternative (a website / an application) of national public services?*" no negative response was selected.

Figure no. 1 The importance of digital public services



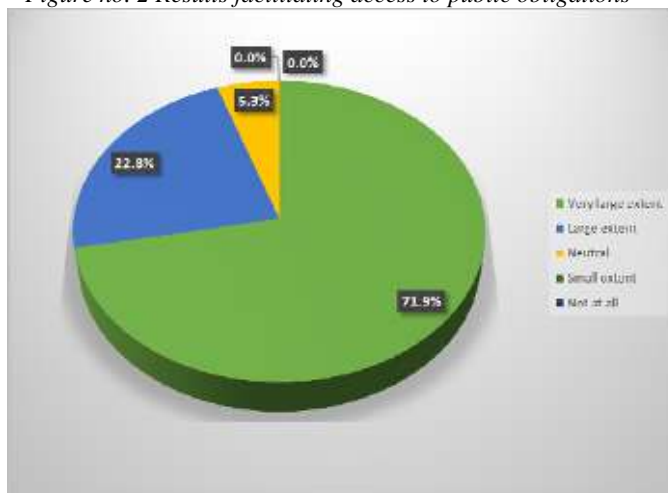
Source: Authors' own research

All the answers generated during the case study highlight a behavioral shift of online consumers and buying triggering / determination factors. Advertising on social media creates a direct link with possible consumers, so they can maximize their options for buying as everyone will choose only what's best for them based on a rigorous search in advance (see Fig. 1).

Regarding the question that refers to the extent to which individuals consider that access to civic obligations is facilitated, the percentage remained approximately unchanged. This time 2 more "neutral" answers were added.

In conclusion, it can be confirmed that those who attach great importance to the digital sector are also insofar as they frequently use and enjoy the benefits of Romanian digital public services.

Figure no. 2 Results facilitating access to public obligations

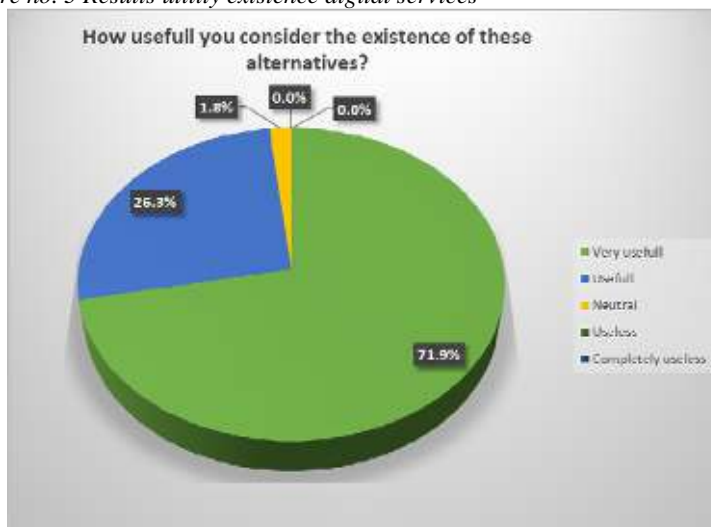


Source: Authors' own research

Analyzing the grades awarded on a scale from 1 to 5 (where 5 represented "very good" and 1 "very bad"), most respondents gave the grades 3-4, which was not good enough, this means that their expectations have not been fully met.

The result of this question can also be interpreted as the need to improve services is still needed, and the efforts of the authorities for modernization must not be stopped.

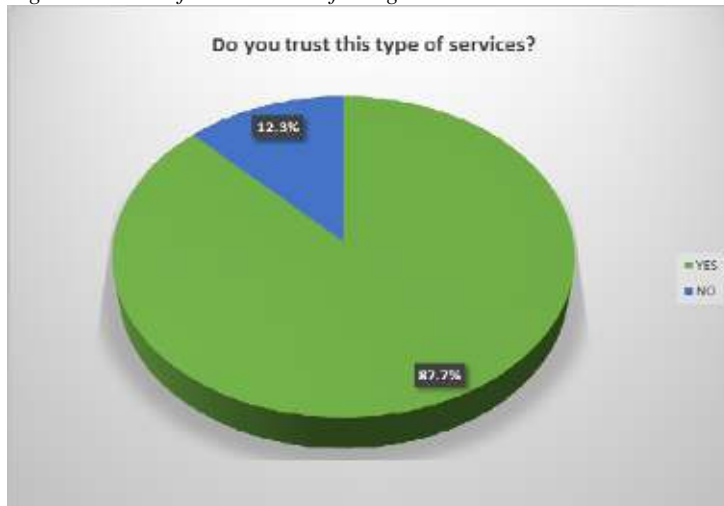
Figure no. 3 Results utility existence digital services



Source: Authors' own research

Continuing in this manner can be analyzed and results of the question *"Do you trust this type of service?"*. From the total of 57 responses, 50 provided an affirmative answer, while the remaining 7 respondents still show reluctance to this topic. From this result it can be inferred that the institutions have not yet managed to reach the opportune threshold by which all the fears of society are covered. This can also be justified on the other hand by the poor transparency offered.

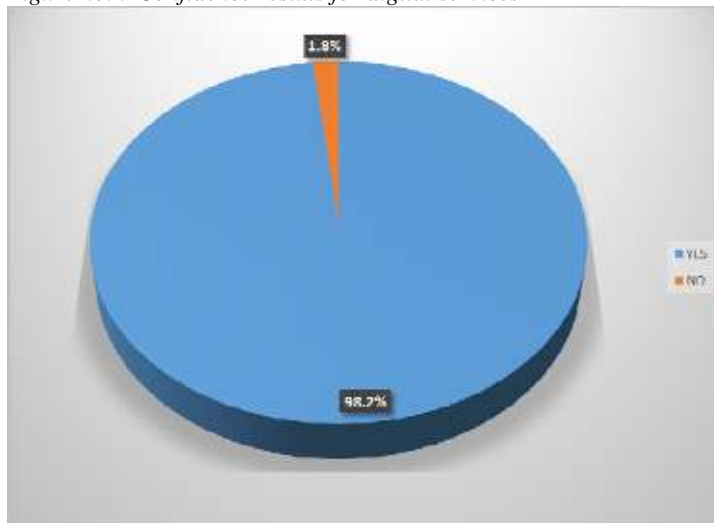
Figure no. 4 Confidence results for digital services



Source: Authors' own research

According to the previous question, it can be added to this specific topic: *"Do you want to expand/modernize these alternatives of public institutions in the future?"*

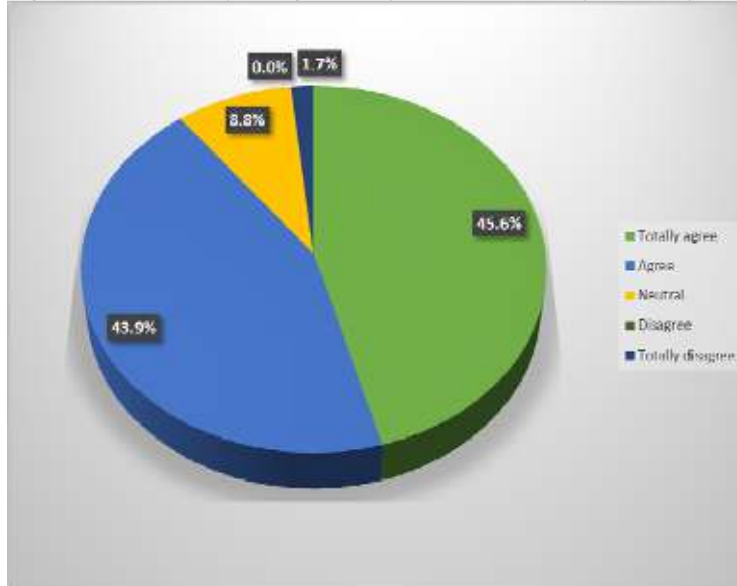
Figure no. 5 Confidence results for digital services



Source: Authors' own research

Next, keeping the line of the idea, follows the question *"Do you agree with the allocation of larger amounts of funds from the public budget in order to develop these digital alternatives?"*.

Figure no. 6 Results of the agreement for the allocation of amounts from the state budget



Source: Authors' own research

The answers to this question keep the same order, and the prevailing idea remains unchanged – society still feels the need for modernization and evolution of digital public systems. The percentage is still positive, which means that resentment is generic and does not differ in different ways.

5. Conclusions

For a public institution to be successful, to give confidence to the citizens who serve it, the level of satisfaction of the beneficiaries must also be considered. Among such types of public service organizations, the satisfaction of beneficiaries is very much related to the quality of the services offered and the time it takes to meet the needs of citizens.

It is confirmed that there are differences between expectations and perceptions, the differences being to the detriment of the service provider. The biggest problems were noted in the modernization of these digital processes, which should no longer be an impediment to the development of society, especially in the context of the pandemic, the report said, but sometimes it raises certain obstacles.

In Romania there is not enough emphasis on the diversification of digital processes, although the opportunities could be multiple. Although our country benefits from a very fast internet network compared to other European countries, they are not yet sufficiently exploited. In this case, not only the lack of infrastructure justifies, but also the lack of budget funds for investment that leads to the low quality of services offered by public institutions.

The research carried out should be continued not only at a theoretical level, but also at a practical level.

Public institutions should seek the satisfaction of beneficiaries, to maximize opportunities and even reduce costs and environmental impact. Overall, we can say that the services offered by the Romanian public institutions have not reached the expectations of the beneficiaries and they are not fully satisfied with the quality of the services offered, on the contrary, they want to improve them.

By recognizing the problem and increasing efforts for continuous improvement, the difference between perceptions and expectations can be significantly reduced, thus providing higher quality services than the current level. Ideally, customer perceptions will later exceed their expectations.

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Aspects of the Strategy for the Development of Public Organizations

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Abstract

The development of public organizations is important in the context of globalization and rapid economic and social changes, which impose the need for increased adaptation and efficiency in the public sector. In this article, we address the major challenges of public administration, such as digitalization, decentralization, and leadership, highlighting the importance of responsible governance. The main purpose is to research, based on a bibliometric analysis from two databases, Scopus and Web of Science, the trends and solutions proposed for the modernization of the public sector; trends revealed in the following articles published on this topic - public development strategies. With this article we contribute to academic discussions on the modernization of public organizations, providing useful insights for policymakers and researchers.

Key words: reform, governance, public administration

J.E.L. classification: H11, H83, O21

1. Introduction

In the contemporary context of globalization and rapid changes in the socio-economic environment, public organizations are facing unprecedented challenges, such as the need for efficiency, transparency, digitalization, and adaptability to communities' needs. Public sector reforms have become a topic in academic research, highlighting the need to modernize organizational structures through effective leadership, decentralization, and the implementation of innovative technologies.

Romania, along with other countries with emerging economies, is experiencing a complex transition from traditional structures to governance models based on principles of responsibility and sustainability. However, the success of reforms depends directly on the leadership capacity of public sector representatives and the implementation of collaborative strategies.

Recent studies indicate that leadership plays an essential role in facilitating these transitions, influencing both the performance of public organizations and citizens' perceptions of the quality of services offered. Also, the digitization of processes, through e-government initiatives, was identified as an important indicator for increasing transparency and improving administrative efficiency.

With this paper we aim to analyse the key strategies for modernizing public organizations by examining the roles of leadership, decentralization, and digitalization, using a bibliometric analysis of academic literature from Scopus and Web of Science.

2. Theoretical background

The governance of public organizations is a central concept for ensuring efficiency, transparency, and accountability in the provision of public services. Rhodes (1997) defines governance as an interaction between governments, and the private and non-governmental sectors, which facilitates coordination and collaboration in the public domain.

Leadership is seen as an important factor for the success of public organizations, and Burns (1978) emphasizes the importance of transformational leadership, which initiates significant changes, compared to transactional, task-oriented leadership. In the public sector, leaders must balance organizational efficiency and the public interest (Van Wart, 2003).

Reforms based on new public management (Hood, 1991) introduced principles such as efficiency and the use of market mechanisms, but also generated controversy, drawing attention to the risks of excessive privatization (Dunleavy et al., 2006). At the same time, digitalization through initiatives such as e-government can improve accessibility but requires strong governance (Heeks, 2006).

In addition to leadership and governance, fostering innovation within public organizations is essential for adapting to the dynamic needs of modern societies. Public sector leaders must not only implement reforms but also cultivate an organizational culture that encourages creativity and proactive problem-solving.

Moreover, the integration of advanced technologies requires a strategic approach to ensure alignment with organizational goals while maintaining the trust and engagement of both employees and citizens. These interconnected elements underscore the complexity of public sector management and the necessity for a balanced and forward-thinking approach.

The development strategy of public organizations is a critical component of their ability to effectively serve the public, remain adaptable, and meet the demands of a rapidly changing world. Unlike private sector organizations that primarily focus on profitability and market competitiveness, public organizations operate within a unique framework where success is measured by social impact, public service quality, and accountability to a wide array of stakeholders, including government bodies, citizens, and various community groups. Consequently, the formulation and implementation of development strategies in public organizations require a nuanced approach that balances efficiency, transparency, and responsiveness with ethical obligations and long-term societal goals.

Public organizations aiming to build resilient and effective development strategies must adopt a holistic approach, integrating these insights to drive sustainable progress and meet the evolving needs of society. As public expectations and global challenges continue to shift, the ability of public organizations to innovate, adapt, and uphold transparency will remain vital in achieving their missions and maintaining public trust.

3. Research methodology

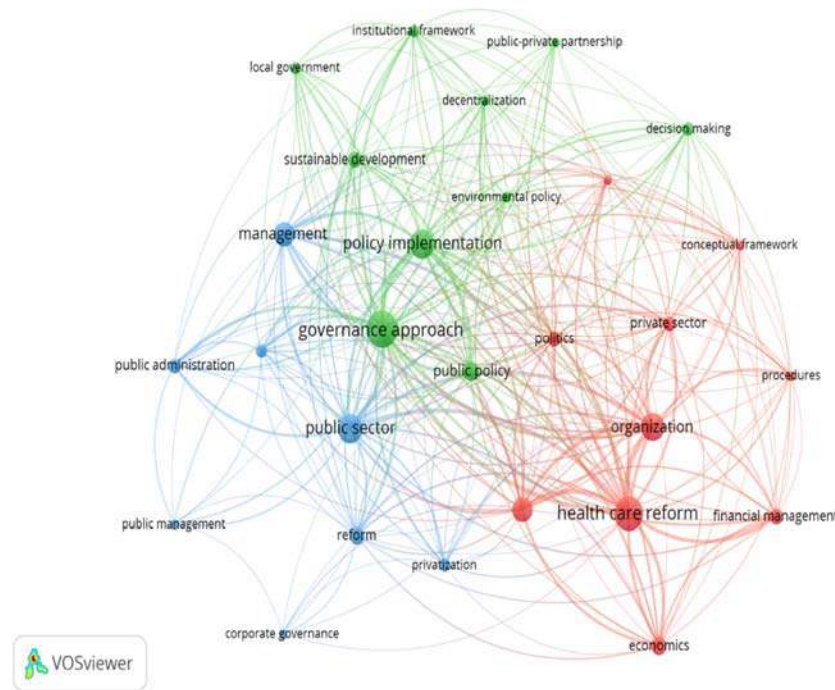
The charts were generated using the VOS viewer software to analyze the relationships between the relevant keywords. We used data from 2 databases, namely Scopus and Web of Science. The keywords selected for the search were "governance", "policy", "public", "management", "reform" and "public sector". Following the search in Scopus, 357 relevant articles were identified, and in Web of Science we identified 648 articles.

4. Findings and discussions

Our analysis of the articles in Scopus and Web of Science indicates a focus on the topics of governance, public management and reforms in the public sector. In particular, there is an upward trend in the importance of digitalisation and participatory governance in public reforms.

Figure 1 shows the literature review based on data from Scopus, and Figure 2 illustrates the results obtained from Web of Science. Both images highlight significant connections and clusters between keywords.

Figure no. 1 Bibliometric analysis of data from Scopus



Source: Own processing using Vosviewer

Our cluster analysis highlights that public sector reform and governance remain central themes in the literature. In both databases (Scopus and Web of Science), terms such as *reform*, *governance* and *public administration* have appeared frequently. The literature also emphasizes the role of decentralization as an essential strategy in the modernization of public administration, allowing for better adaptation to local needs (Haque, 2020; Luo et al., 2020). Through decentralization, regional administrations gain greater autonomy, which supports the implementation of reforms adapted to the local context.

Also, articles such as those by Zhang and Yu (2021) highlight the importance of policy transfer and international collaboration in the implementation of public reforms. These results reflect a global convergence in prioritizing effective governance and sustainable strategies in the public sector.

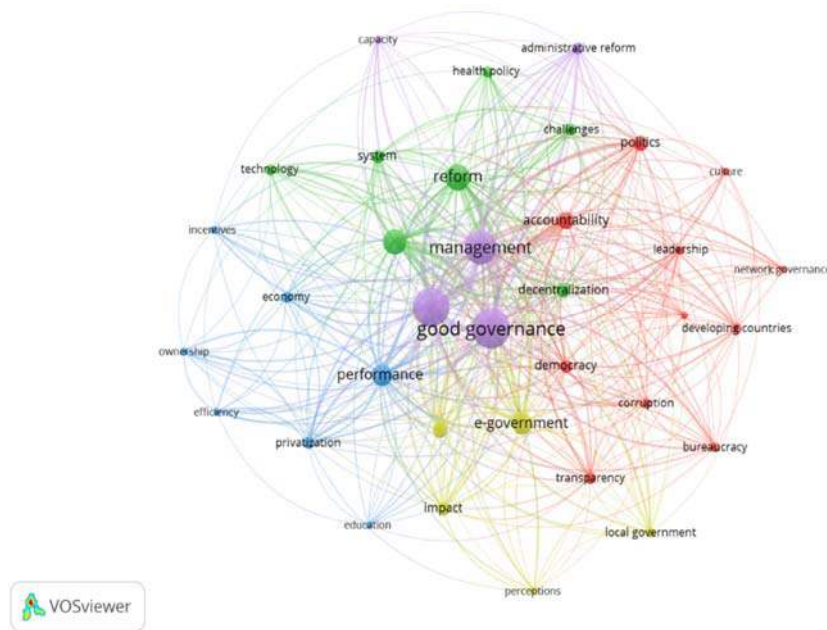
We believe that digitalization is a key component for the modernization of public organizations, but its success depends on the acceptance and understanding by citizens and employees.

The leadership cluster identified in Figure 2 highlights the importance of this concept in the process of reforming public organizations, especially in developing countries, such as Romania. Leadership is associated with terms such as network governance and collaborative management (Haque, 2020; Meuleman, 2021). These associations suggest that effective leadership plays a critical role in implementing reforms and improving governance in complex and decentralized environments.

Thus, we conclude that leadership is an important factor for the success of reforms and effective governance, especially in complex or decentralized environments.

The yellow cluster in Figure 2 underlines the importance of digitalization and e-government technologies in the modernization of public organizations. Terms such as perceptions and performance, frequently present in the analyzed articles (Citro et al., 2021; Cowell et al., 2020), suggest that citizens' perceptions significantly influence the success of the implementation of these technologies. In contrast, Figure 1 does not include this topic as a separate cluster, but refers to technology in the context of economic reforms.

Figure no. 2 Bibliometric analysis of data from Web of Science



Source: Own processing using VosViewer

The purple cluster in Figure 2 emphasizes principles such as good governance, accountability and transparency, highlighting the concern for integrity and responsibility (Teye & Nikoi, 2023; Masum & Parker, 2024). At the same time, the green cluster in Figure 1 explores governance approaches oriented towards environmental policies and sustainable development. Both databases suggest that implementing sustainable policies and promoting transparency principles are key to the success of modern public organizations.

In both databases analysed (Scopus and Web of Science), the themes of reform and decentralization are repeated, indicating an academic consensus on the need to adapt organizational structures to the requirements. The green cluster in Figure 1 and the one in Figure 2 emphasize the role of decentralization in administrative efficiency and in promoting local participation. According to the research of Lankina (2020) and Mungiu-Pippidi (2023), decentralization is considered an important tool for the modernization of public administration, allowing greater flexibility of public structures and supporting regional development initiatives.

Moreover, decentralization is directly proportional to increasing the accountability of local authorities and adapting more effectively to the specific needs of the community, as evidenced by the work of Hill et al. (2022). These reforms simplify local decision-making and contribute to a fairer distribution of resources, thus supporting long-term regional development.

5. Conclusions

We can conclude from this analysis that the development strategies of public organizations are based on four main pillars: reform, decentralization, leadership and digitalization. Reform and decentralisation allow for flexibility, accountability and adaptation to local needs, supporting regional development. Effective leadership plays an important role in managing change and implementing reforms, while digitalization, through initiatives such as e-government, increases efficiency and transparency. The success of modern public organizations depends on integrating these elements into a governance based on the principles of sustainability, transparency and accountability, in order to meet the needs of citizens and global challenges.

The analysis is based only on the articles available in Scopus and Web of Science, which may limit the diversity of sources. Second, the use of keywords may not always capture the thematic nuances of each article, and the relationships identified between terms do not necessarily reflect the

causality or depth of the topic. The analysis is also based on articles in English, and this aspect limits our research.

Despite these limitations, the findings provide valuable insights into the key components required for the modernization of public organizations, offering a foundation for future research and practical applications in policy-making and organizational development.

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Exploring the Determinants of Operational Performance in the Water Supply Sector: A PCA Analysis of Networks, Meters, Raw Water and Operating Costs

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Abstract

The water sector is essential for sustainable development, but faces complex challenges arising from climate change, accelerated urbanization, and increasingly stringent economic and environmental demands. This study examines the determinants of operational performance in the water sector, using principal component analysis (PCA) to analyze key variables such as distribution networks, meter usage, raw water characteristics, and operational costs. Results highlight that infrastructure modernization, implementation of digital technologies, and use of circular economy principles are essential for sustainability. The analysis also underscores the link between infrastructure investments and water loss reduction, cost optimization, and service improvement. Temporal evolution reflects a transition from major operational difficulties to improved performance, thanks to effective investment strategies. The conclusions provide valuable insights for strategic decision-making and recommend integrated approaches that ensure the balance between economic sustainability, technological efficiency, and social responsibility, thereby contributing to the management of water resources for the benefit of future generations.

Key words: principal component analysis (PCA); wastewater management; performance of water operators

J.E.L. classification: C10, Q53, R10

1. Introduction

Access to safe and affordable drinking water is recognized as a fundamental necessity and a universal right (Brașoveanu, 2023c, p.23), but achieving this goal faces multiple obstacles globally. The water sector is exposed to complex challenges, stemming from the interaction between climate change, population growth, accelerated urbanization and rising costs associated with resources and energy. At the same time, operators in the sector face strict requirements regarding service quality, economic sustainability and operational efficiency, all in the context of an often outdated infrastructure and strict regulation (Sakai, 2024, p.169).

The operational performance of water supply services is a central concern for operators and authorities worldwide, with a significant impact on the quality of life, economy and environment. Water systems, which include water abstraction, treatment, transport and distribution, operate in a dynamic environment, where limited resources must be managed efficiently to meet increasing demand and to avoid losses and risks associated with unequal access to water (Vilanova, Magalhães Filho and Balestieri, 2015, pp.2-3). Given the current trends of integrating economic

mechanisms into the sustainable management of water resources, it becomes imperative to analyze the factors that influence the performance of these systems, in order to ensure both sustainability and efficiency (Platon *et al*, 2024, p.658).

This article aims to explore the interdependencies among the determinants of operational performance in the water sector, with a focus on distribution networks, meter use, raw water characteristics and cost management. By identifying the challenges and opportunities associated with these drivers, the paper provides an integrated perspective on how the water sector can respond to current challenges and contribute to sustainability and equity goals.

2. Literature review

The water sector is a critical component for sustainable development, while at the same time a challenge due to climate change, population growth and increasingly stringent regulatory requirements. Efficient management of water resources requires the implementation of sustainable and innovative strategies that integrate both economic and environmental perspectives (Ramos *et al*, 2019, p.2).

Sala-Garrido *et al* (2023, p.121078) emphasize the importance of dynamically evaluating the performance of water operators in terms of service quality and economic sustainability. They suggest that an effective management system should integrate both operational variables and customer satisfaction aspects, such as continuity of supply and loss reduction (Sakai, 2024, p.177).

The operational performance of water services is often assessed through efficiency and sustainability indicators, which reflect the ability of operators to manage resources in an optimal way. Alegre *et al* (2016, pp.52-58) highlight the importance of using standardized metrics, such as water losses, operational cost coverage and service quality, to support informed decision-making.

In Romania, a recent study (Moise 2024, p.209) shows that the regionalization of water operators has had a positive impact on financial and operational efficiency. These reforms have been accompanied by significant investments in infrastructure, supported by European funds (Stan and Cojocaru, 2022a, p.467; Stan and Cojocaru, 2022b, p.181; Stan and Tasește, 2023, p.172), which have contributed to reducing losses and increasing the quality of services, as well as the adoption of a favorable legislative framework (Brașoveanu 2023a, p.46; 2023b, p.52) that amplifies the positive effects of an efficient management system. At the same time, the analysis carried out by Bakó and Fulop (2017, p.96) highlights that the financial performance of water operators can be improved by consolidating infrastructure and optimizing resources.

Distribution networks play a critical role in operational performance and water losses are a key indicator of efficiency. Hangan *et al* (2022, p.19) and Micu *et al* (2013, p.147) point out that the implementation of advanced technologies such as digital monitoring and smart meters, although involving high upfront costs, is essential to reduce losses, optimize consumption and increase transparency in dealing with consumers. In addition, risk management and the restructuring of operational processes are fundamental elements for increasing the competitiveness of water operators (Stroie *et al*, 2023, p.71; Aivaz *et al*, 2023, p.936). Reducing operating costs, either by upgrading infrastructure or digitizing processes, can ensure better resource allocation and more efficient adaptation to consumer demands. The integration of these strategies allows operators to better respond to market demands, while helping to improve service quality.

The quality of raw water directly influences the complexity of treatment processes and related costs. Mensah-Akutteh *et al* (2022, p.2) emphasize that water sources with high levels of contamination require advanced treatment technologies, which significantly increases operational costs. Bhojwani *et al* (2019, p.2750) analyze the technologies used in water treatment, demonstrating that investing in innovative solutions can reduce long-term costs and improve efficiency.

In this respect, an important factor is the digitalization and transformation of water organizations through the integration of modern technologies. Recent studies highlight that digitization not only supports operational efficiency (Munteanu *et al*, 2023, p.204), but also facilitates transparent interaction with consumers, providing a better understanding of their behavior (Boyle *et al*, 2022, p.6). These transformations are underpinned by circular economy strategies, which emphasize reusing resources and reducing reliance on conventional solutions

(Mbavarira and Grimm, 2021, p.5).

In terms of operational costs, the energy used for pumping and treating water represents a significant part of the total expenses of operators (Bhojwani *et al*, 2019, p.2750). In this context, strategies such as resource recovery and the integration of renewable sources become essential for sustainability. In addition, the integration of circular economy principles in water resource management can lead to the diversification of income sources and the reduction of operational costs (Munteanu *et al*, 2024, p.3).

At the same time, research and innovation funding also plays a key role in improving operational performance. Rus (2018, p.506; 2023, p.1053) emphasizes the importance of collaboration between the private and public sectors to develop sustainable solutions. In this regard, investments in research and development have contributed to the creation of more efficient technologies, adapted to local needs and international standards (Aivaz, 2021, p.9).

In conclusion, to meet the complex and dynamic demands of the water sector, it is essential to adopt practices that integrate advanced technologies, optimize infrastructure and reduce operational costs. By promoting sustainability and efficiency, utilizing renewable resources and circular economy principles, operators can improve service performance and contribute to a more responsible management of water resources, thus balancing economic, social and environmental needs.

3. Research methodology

This research aimed to explore and analyze the determinants of operational performance in the water sector, using a quantitative approach based on principal component analysis (PCA) (Mirea and Aivaz, 2016a, pp.202-203; Vancea *et al*, 2021, p.52). The study aimed to reduce the size of the data set and identify the main factors that explain the variation in the data, thus contributing to the understanding of the dynamics of operational performance according to the variables studied. The data used were obtained from administrative and operational sources relevant to the water sector, covering a period of 11 years. The variables analyzed included key indicators such as the percentage of non-revenue water (Op-RO-026), the volume of raw water paid to Apele Române (CI-RO-103a), the volume of raw water imported (A-RO-002a), the length of water networks (C-008), the number of meters installed at household consumers (E-007) and economic agents (E-008), as well as the total operating expenses (G-RO-005). These variables were selected to capture the essential dimensions of operational performance, infrastructure and associated costs.

To explore temporal dynamics, the scores of the main factors were used to generate scatter plots, highlighting changes over the analyzed period. The distribution of years according to the factor scores was analyzed to identify transition and performance stages, reflecting the evolution of the water sector.

The methodology used has demonstrated that principal component analysis is an effective tool for identifying determinants in the water sector (Mirea and Aivaz, 2016b, p.192). It provided a solid basis for interpreting operational performance and highlighted the importance of temporal evolution and the interaction between infrastructure, operational losses and costs. Despite its limitations, the results provide valuable insights for strategic decision-making and for guiding future policies in the water sector.

4. Findings

Table 1 provides an overview of the main statistical indicators used to analyze operational performance in the water sector. The analysis shows that the percentage of non-revenue water, with an average of 48.73%, represents a significant challenge for the sector, indicating significant losses that could be caused by factors such as physical losses, theft or inefficiencies in network management. The variability of this indicator, with a standard deviation of 5.66%, suggests a relatively high consistency of this problem across the regions analyzed.

Table no. 1 Statistical description of the main statistical indicators used to analyze operational performance in the water sector

	Mean	Std. Deviation	Analysis N
Op-RO-026	48.73	5.66	11
CI-RO-103a	79138788.81	6052466.60	11
A-RO-002a	1289585.81	1844540.71	11
C-008	3812.45	253.15	11
E-007	125020.18	17433.76	11
E-008	10886.091	2680.8621	11
G-RO-005	166532365.636	38578660.5150	11

Source: Authors' work

The volume of raw water paid to Apele Române averages 79.14 million cubic meters per year, which highlights a significant dependence on domestic raw water resources. This value is relatively stable, as indicated by the standard deviation of 6.05 million cubic meters. In contrast, the volume of imported raw water, although significantly lower, with an average of 1.29 million cubic meters per year, shows a much greater variation between years or regions, which may reflect fluctuations in the availability of domestic resources or the need for supply from external sources.

The water distribution network is extensive, with an average length of 3812.45 km. This appears to be relatively evenly distributed, as suggested by the standard deviation of 253.15 km, indicating that the water networks are similarly adapted to the needs of the different regions analyzed. Regarding consumption monitoring, the average number of meters installed at household consumers is 125,020, reflecting a considerable effort to accurately measure consumption. However, a standard deviation of 17,433 meters indicates significant differences between regions, probably caused by different levels of infrastructure development. In the economic agents and institutions sector, the average number of meters is much lower, at only 10,886, suggesting a lower coverage compared to the household sector. The variation in this indicator is however notable, with a standard deviation of 2,680, which may reflect differences in the density of economic agents or institutions in different regions.

The total operating costs of water sector activities are considerable, averaging 166.53 million lei per year. The standard deviation of 38.57 million lei suggests moderate variations between regions, which can be influenced by factors such as network size, operational efficiency and local tariffs. This high value of expenses, correlated with high non-revenue water losses, underlines the need for effective strategies to reduce costs and improve operational performance.

The analysis suggests that the water sector faces significant challenges, both in terms of efficient resource management and cost optimization. Reducing water losses and expanding metering infrastructure are priority directions to improve the sustainability and operational performance of this essential sector.

Table 2 of the correlation matrix provides essential information about the statistical relationships between the variables analyzed in the water sector, highlighting the strength and direction of the links between them. Interpretation of the correlation coefficients allows the identification of possible direct and indirect links that influence operational performance and resource use.

The results show that the percentage of non-revenue water (Op-RO-026) is strongly positively correlated with the volume of raw water paid to Apele Române (CI-RO-103a), with a coefficient of 0.859. This relationship suggests that as the amount of raw water purchased increases, there is also an increase in water losses, indicating inefficiencies in the distribution system or in consumption measurement. In contrast, non-revenue water has a moderate negative correlation with the total length of water networks (C-008) and with the number of meters installed for both household consumers (E-007) and economic agents (E-008). These negative correlations suggest that a better developed infrastructure and more efficient measurements can contribute to reducing water losses.

Imported raw water (A-RO-002a) shows significant positive correlations with the length of water networks (C-008), the number of meters (E-007 and E-008) and total operating expenses (G-RO-005). These relationships indicate that raw water import may be associated with a well-

developed infrastructure and higher operating costs, which could reflect the complexity of operations in regions requiring water imports.

The length of water networks (C-008) has very strong positive correlations with the number of meters for households and economic agents, with coefficients of 0.967 and 0.893, respectively. This relationship emphasizes that in regions where the distribution network is extensive, there is also a better developed infrastructure for consumption metering. At the same time, network length is strongly positively correlated with operating costs, suggesting that managing larger networks implies higher operating costs.

The number of meters for household consumers (E-007) and economic agents (E-008) show significant positive correlations with each other, suggesting a uniform approach in the installation of meters for the different categories of consumers. Both variables are also positively associated with operating expenditure, indicating that consumption metering requires additional financial investment.

Table no. 2 Statistical relationships between the variables analyzed

		Op-RO-026	CI-RO-103a	A-RO-002a	C-008	E-007	E-008	G-RO-005
Correlation	Op-RO-026	1.000	.859	.208	-.347	-.333	-.181	-.498
	CI-RO-103a	.859	1.000	.194	-.105	-.132	-.005	-.171
	A-RO-002a	.208	.194	1.000	.617	.624	.773	.508
	C-008	-.347	-.105	.617	1.000	.967	.893	.876
	E-007	-.333	-.132	.624	.967	1.000	.843	.844
	E-008	-.181	-.005	.773	.893	.843	1.000	.745
	G-RO-005	-.498	-.171	.508	.876	.844	.745	1.000
Sig. (1-tailed)	Op-RO-026		<.001	.270	.148	.159	.297	.060
	CI-RO-103a	.000		.284	.379	.349	.494	.308
	A-RO-002a	.270	.284		.021	.020	.003	.055
	C-008	.148	.379	.021		.000	.000	.000
	E-007	.159	.349	.020	.000		.001	.001
	E-008	.297	.494	.003	.000	.001		.004
	G-RO-005	.060	.308	.055	.000	.001	.004	
a. Determinant = 3.300E-5								

Source: Authors' work

Operating expenditures (G-RO-005) have significant positive correlations with most indicators, except non-revenue water, where the relationship is moderately negative (-0.498). This could signal that regions that invest more in operations are able to reduce the proportion of water losses.

The statistical significances associated with the correlation coefficients show that most of the identified relationships are statistically significant, with probability values below the 0.05 threshold for the strongest correlations. This analysis suggests that operational performance and resource utilization in the water sector are influenced by complex interactions between infrastructure, metering and operational costs. Reducing water losses and optimizing expenditures could be achieved by improving infrastructure and monitoring systems.

Table 3 provides insight into the contribution of each factor (principal component) in explaining the total variance in the dataset. The analysis identified seven principal components, but only the first two have eigenvalues greater than 1, suggesting that these are the significant components according to Kaiser's criterion. The remaining components have eigenvalues below 1 and do not make a significant contribution to the total variance.

The first principal component has an eigenvalue of 4.221 and explains 60.301% of the total variance in the data. This indicates that most of the information in the original variables can be concentrated in this component, making it the most important in the analysis. The second principal component has an eigenvalue of 1.979 and explains an additional 28.265% of the total variance. Together, the first two components accumulate 88.566% of the total variance, which means that almost 89% of the original information is preserved by using these two components.

This shows that the dataset size can be significantly reduced without losing essential information. The analysis suggests that the first two principal components are sufficient to summarize the major variation in the data. This result supports the effectiveness of PCA analysis in reducing the size of the data and identifying the main factors influencing the analyzed variables.

Table no. 3 Contribution of each factor (principal component) in explaining the total variation in the dataset

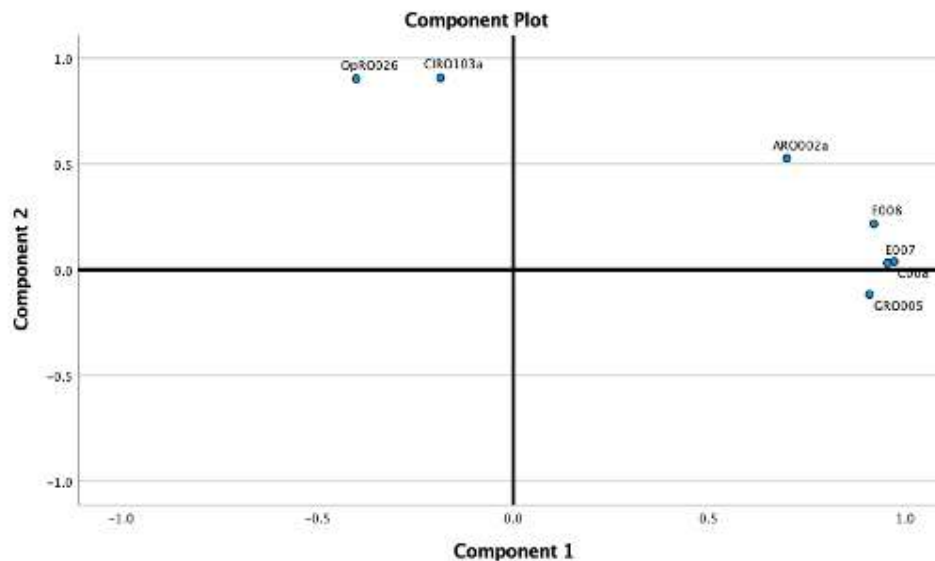
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.221	60.301	60.301	4.221	60.301	60.301
2	1.979	28.265	88.566	1.979	28.265	88.566
3	.443	6.333	94.899			
4	.186	2.664	97.563			
5	.132	1.888	99.451			
6	.022	.313	99.764			
7	.017	.236	100.000			

Extraction Method: Principal Component Analysis.

Source: Authors' work

Figure no. 1 provides a two-dimensional representation of the variables analyzed in terms of the first two principal components identified in the PCA analysis. These principal components explain the majority of the variation in the data, and the positioning of the variables on the Component 1 and Component 2 axes reflects their relationships with these principal factors.

Figure no. 1. Two-dimensional representation of the analyzed variables in terms of the first two components



Source: Authors' work

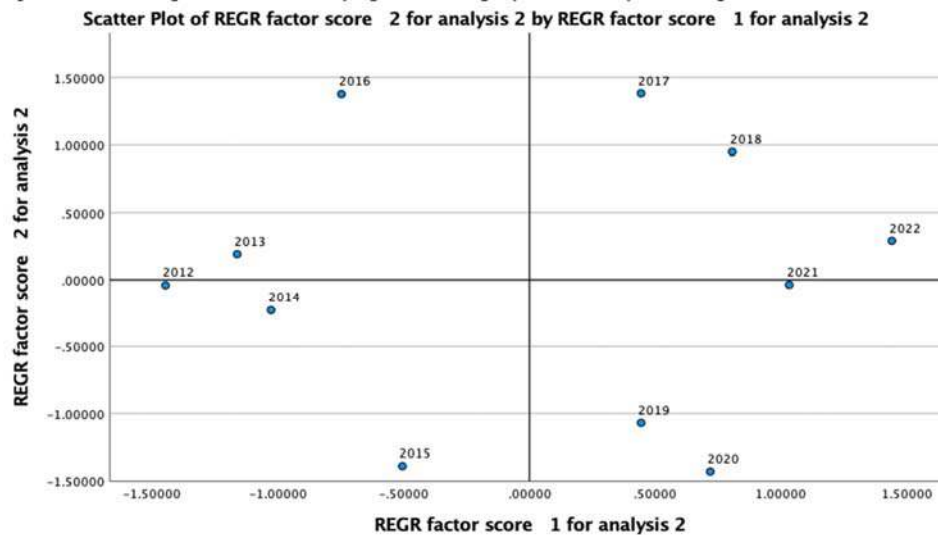
Op-RO-026 and **CI-RO-103a** are very close on the Component 2 axis, suggesting a strong relationship between them and a common influence of this component. This indicates that non-revenue water losses and raw water paid to Apele Române are correlated factors, jointly influencing operational performance. **A-RO-002a** (imported raw water) is positioned further along the Component 1 axis, showing a distinct relationship with other factors representative for this component. Its more isolated positioning suggests a specific influence on the variation in the data. **E-007**, **E-008** and **C-008**, representing the measurement infrastructure and water network, are very close together on Component 1, showing a close relationship between them. This closeness

indicates that these variables contribute similarly to explaining the variation in Component 1, reflecting the importance of infrastructure in overall system performance. **G-RO-005** (operating costs) is also positioned close to the infrastructure variables (E-007, E-008 and C-008), indicating a link between operating costs and infrastructure development.

Therefore, the graph suggests that there are two major groups of variables: the first, represented by Op-RO-026 and CI-RO-103a, indicates losses and purchases of raw water, and the second, consisting of E-007, E-008, C-008 and G-RO-005, indicates the link between infrastructure and operational costs. A-RO-002a stands out as a variable with a unique contribution, but less correlated with the other groups. These relationships provide a solid basis for identifying the main factors influencing operational performance in the water sector.

Figure no. 2 illustrates a clear temporal evolution in the operational performance of the water sector, suggesting a significant transformation over the years analyzed. The positioning of the years 2012-2015 in the lower left indicates a period characterized by major difficulties. During this phase, the sector likely faced high water losses that were not generating revenue, lack of adequate infrastructure, and high operating costs that were not supported by efficient performance. These problems could be the result of lack of investment or less efficient management.

Figure no. 2. Temporal evolution of operational performance of water operators



Source: Authors' work

The following years, from 2016-2020, are distributed in an intermediate area of the graph, suggesting a transition phase. This period is characterized by the implementation of the first improvement measures, such as investments in infrastructure and modernization, which have started to gradually reduce losses and optimize operating costs. The effects of these measures seem to have been visible in the steady progress of the sector, although the overall performance had not yet reached an optimal level.

In the upper right part of the graph, the years 2021 and 2022 mark a stage of significantly improved performance. This positioning indicates positive results, supported by better developed infrastructure, increased operational efficiency and a significant reduction in water losses. This progress is likely the result of better-founded policies, consistent investments and the use of modern technologies. The clear separation between the early years, which highlight a problematic state, and the recent years, which reflect high performance, suggests a gradual and systematic transformation of the sector.

This evolution indicates that the water sector has undergone a process of continuous adaptation and improvement, highlighting the benefits of modernization and efficiency strategies implemented over time. The changes reflected in the graph are the result of a concerted effort to overcome initial challenges and ensure more efficient management of resources and costs.

5. Conclusions

In conclusion, the water sector is a vital component of sustainable development, and success in this area depends on the integration of advanced technologies, cost optimization and the adoption of sustainable strategies. Efficient resource management involves not only modernizing infrastructure, but also implementing proactive measures such as reducing leakage, using energy efficiently and applying circular economy principles to minimize waste and maximize resource reuse. Operational performance, defined by reducing water losses, expanding metering infrastructure and improving customer relationships, thus becomes a key indicator of the sustainability of this essential sector.

The results of the analysis highlight the close relationship between operating expenditure and infrastructure development, revealing the importance of well-structured investment policies, supported by European funds, which have facilitated an increase in the quality of services and a reduction in resource vulnerabilities. The study shows that determinants factors, such as the length of the distribution network and the number of meters, significantly influence the operational efficiency and sustainability of the system, being supported by digitization and the use of smart technologies to monitor consumption and improve performance.

Furthermore, PCA analysis and correlation matrix confirm that most of the data variation can be explained by a few principal components, providing a solid basis for strategic decisions. The performance evolution graph indicates a clear transition from major difficulties to improved performance, reflecting the positive effects of investments and strategies implemented over time. Reducing losses, diversifying revenue sources and implementing digital solutions remain critical priorities to ensure efficient management of water resources and to respond to current challenges, thus contributing to the well-being of future generations and the balance between economic, social and environmental requirements.

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The Crisis of Leadership in the Context of Globalization

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Abstract

Probably one of the most often invoked explanations for the economic, political or administrative disaster refers to the lack of leadership. In this paper, I set out to present the results of the analysis of the notion of leadership as well as how leaders choose to treat different organizational situations. Although I do not claim to possess the ultimate truth regarding the aspects researched through this paper, I believe that these aspects can add value to this major theme called leadership. In this sense, the novelty and scientific originality of the ideas obtained materialized in making clear opinions regarding leadership, management and their crises in the 21st century.

Key words: leadership, globalization, pandemic, crises

J.E.L classification: F16, F40, F62

1. Introduction

In the 20th century, in the perimeter of economic sciences, a new notion took shape, namely that of management. Moreover, this gives you more and more to cover the one of leadership. A careful review of the specialized literature highlights the presence of three typical situations regarding the use of the notions of leadership and management. The first of these tends to identify the two notions. In those cultures where there are no distinctive terms to present the two realities, they are substituted, without differentiating in any way. In the case of the Romanian language, these terms were translated by the term management. The second situation is at the opposite pole, that is, it categorically differentiates the two elements, after analyzing certain criteria that characterize leaders and managers. The former focuses on style, staff, skills and goals, and the managers on strategy, structure and system. The third situation is intermediate and lies between the two extremes. Most consider that leadership is a part of management, maybe even the essential part. There are also points of view, less frequent, that present management as part of leadership.

In the specialized literature, there are several forms of leadership: predictive (that is, focused on the surprise and anticipation of the organization's future coordinates); strategic (focused on the strategy to be followed by the organization for its evolution); dynamic (conceiving and mastering the processes developed over time that ensure organizational success or failure); by exception (it focuses on certain problems or periods that deviate from the rule, thus constituting exceptions); through innovation (innovative transformations within the organization).

2. Theoretical background

Why are organizational goals so important in organizational theory dealing with power and politics? Because they provide rationale and legitimacy for resource allocation decisions. The "modern" structural school as part of the organizational theory gives great importance to legitimate authority (authority arising from the organizational hierarchy) and formal rules (promulgated and reinforced by authority) to ensure that organizational behavior is directed around the achievement of established organizational objectives.

The concept of management refers to the assumption of responsibility for the achievement of an objective and the efficient allocation of resources (material and human) for this purpose. On the other hand, the concept of leadership refers to the process of influencing and directing the members of the organization towards achieving the objective. Warren Benis and Bart Namus managed to summarize the difference between leadership and management in one sentence: "Managers are people who do things the right way, and leaders are people who do the right things".

As can be seen, the leader of the public organization has a variety of means of influencing subordinates in the direction of achieving the institution's objectives. All these elements can signify, from the perspective of an intelligent leader, possibilities of expanding formal power and influence on higher dimensions. The defining characteristic of the manager is his power over others.

The motivations of the leader are related to the realization of projects that lead to the development of organizations and the promotion of collaborators on higher levels of competence, compared to the individual who has strict personal reasons to dominate.

3. Research methodology

The research questions set are "can leaders manage strategic crises?" and "can leadership combine resources with results?" The research is focused on all literature reviews, literature relevant to the research topic and research that has a qualitative and quantitative aspect, followed by interpretation and analysis.

4. Findings

The identity of a crisis is not easy to present, but it also connects with other forms of manifestation: either from different or similar patterns. In crisis situations, survival instinct causes people to conform to the dominant political or economic power.

The lens of nature - through which every citizen looks, but perhaps especially the employee - shows that those in power should live up to their task. We are talking about fulfilling responsibilities for the benefit of organizations and/or nations. But this attitude, characteristic of healthy leadership, is "impeded" by at least two limits: the pursuit of obtaining the greatest possible results, with any effort - along with the obsession of reporting and comparing these effects. They can overshadow the well-being of organizations, companies and countries. Therefore, economic development risks turning from a desire of any state/leader, into an approach manifested on swampy grounds, "volatile, uncertain, complex and ambiguous" (Cris Pearce, 2018).

The current period is one of severe economic and social uncertainties. And because the key element of a crisis manifested in such a conjuncture is its recognition, the leader's response must not be late. Apart from the temporal reference, it is equally important that this response is effective (which, according to some opinions, does not exclude its improvised character (McKinsey&Company, 2020).

Of course, real leaders must manage crises coherently and creatively, even if - in essence - many severe crises are not predictable (or, anyway, not to the desired level).

Every time a detail becomes important: either the context, or the resistance to change, or the manner of action. But some crises generate martyrs, others - distorted leaders; some crises are useful, others destroy; some crises create new societies as suddenly as others topple governments.

We recall, as an example, the so-called "empty chair" crisis, triggered at the level of the former European Economic Community (EEC) in 1965, following the dispute related to the financing of the common agricultural market. The perception of an "independently" controlled market was not accepted by France, which withdrew for a period from the meetings of the Community bodies of those times (between July 1, 1965 - January 29, 1966). The crisis was ended by the "Luxembourg Compromise" (which admitted "the application of qualified majority voting" [General Secretariat of the EU Council, 2013:12]).

Even so, France's attitude at the negotiation table and the resolution of that problem remain evidence of the first struggles for economic power, at the European community level. At the same time, it certifies - over time - the fact that European leaders (countries and individuals) did not appear by chance.

If recognizing the signs of a crisis is part of a commander's training, then vigilance, cooperation and honesty must be some of his basic capabilities. For example, leaders of nations become great leaders when they manage strategic crises. They prove the legitimacy of public power when they make good decisions for the country - which are not necessarily egalitarian but can be fair and just for most of the population.

5. Conclusions

Leaders choose to treat crises only in one or two perspectives: either as a chance to win the confrontation based on the information they have, or as a test they are going through, even being defeated. Irrespective of the way followed in the management of problems (flexible or not), leaders must contribute to the generation and development of the feeling of belonging to the community, concerned with the promotion of its values. for the stated purpose, we consider that the SMART objectives (indicated in the projects of economic entities generating goods and services) can be extended to the priorities of the leaders of nations:

- ❖ "S" becomes a landmark of national specificity.
- ❖ "M" measures quantitative and qualitative indicators, monitoring the progress of a country.
- ❖ "A" aims both at allocating resources and assessing the most suitable ways of working, in correlation with the inputs.
- ❖ "R" implies the selective refinement (perhaps even elitist, - of a nation's values.
- ❖ "T" can finally appeal to the tolerance necessary for evolution - in the sense of accepting diversity.

But world leaders (from whatever field they may be) do not necessarily model viable and dignified behaviors; they don't always make the same sacrifices that they themselves ask of their own team members; I don't show a sense of responsibility in all situations that require it; they do not always resist the pressures imposed from outside or inside the organization. At least for the reasons stated, today the world is facing a leadership crisis, which must be managed alongside the other crises (democracy, health, energy, elites, cultural, etc.).

From another point of view, the radicalism of the present period brings back to our attention concepts such as protest (economic, social, civic, military), anti-authority and anarchy, which are added to individualism (addressed earlier in this book). Related to such manifestations, the reconfiguration of leadership under the conditions of the third millennium must try to break away from impulsive constraints (irritability, incitement, aggression or even violence). It is necessary to promote the goals of economic entities in non-discriminatory conditions, as personal / favoring variables cannot constitute fundamental and sustainable benchmarks of the decision-making process.

Quality leadership must "reconcile" not only the resources (inputs) with the results (outputs) - as was the case until now - but also orient to other considerations: technological atomization vs. computerization; micro-tasks indicated to employees vs. streamlining activities; pixelation²⁷⁶ vs. the need for open spaces, etc. The stake of these actions (be they conversions, interpretations, symbolizations or catalysis) is the establishment of new competitive advantages, respectively comparative. They are intended to change the routines of companies, to provide instructions for everything, to capture and even monopolize the attention of the economic environment. There would be nothing offensive in these leadership concerns, if they were not sometimes exaggerated in corporations: too great demands, directed at employees; the consideration of the material sphere as pre-emptive, to the detriment of human values; finally, the known excessive orientation towards profit, as a brake on conviviality. As an example, there is nothing new in considering that "efficiency and super-modernity" are positioned at the center of the concept of global capitalism.

Therefore, creative solutions are imposed by virtue of an ultimately natural goal: that of winning. We look at atomization in the sense of minimizing the dimensions of some production factors or goods, respectively some of their components (fractions). Example: Office computers or medical equipment no longer have the dimensions of those of a few decades ago, at least because the constituent parts are no longer so large, and the operating principles are also modernized.

Vision obsession over all the details processed in video display systems. We refer to the recalibration of the value of some assets or properties, according to predominantly material criteria. Example: Gentrification is the action of revitalizing old or damaged areas or neighborhoods, through the intentional (planned) influx of wealthy residents. Apparently, it enables only innovative spirit and effort directed towards society. If the first stage of this process determines by itself the growth of Walloon: properties, the later stage involves the displacement of families with modest incomes and small companies - which either lived or previously worked in the area. They can withstand the financial pressure and leave the neighborhood, looking for cheaper locations.

The operation is completed in a hypocritical way: the "getting rid" of tenants with possible modest (unwanted) monetary returns takes place without appearing to be a request of the project, d: deliberate decision of those who leave the area. We regard conviviality as a set of relationships between people or groups belonging to the same entity (society, corporation, firm), which is based on their ability to tolerate and respect each other, even if they do not understand each other completely.

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Assessing the EU Energy (In)Dependency on Conventional Resources in Times of War

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Abstract

International economic and geopolitical changes caused by the war between Russia and Ukraine have intensified the EU member countries' concerns about the supply of energy resources and its energy security. The aim of the paper is to highlight the differences between EU countries in terms of energy dependence on conventional resources, mainly natural gas, petroleum products and fossil fuels. The research methodology implies a composite index applied for the period 2014-2022. The results show that there are three dimensions of energy dependence for EU countries, such as internal consumption and external supply (D1), self-sustaining capacity with natural gas (D2), and self-sustaining capacity with fossil fuels (D3). Germany, Italy and France have a high degree of energy dependence, while countries such as Poland, Romania and the Netherlands have a low level. These differences between EU countries show that the EU's energy security objectives should focus on renewable energy sources.

Key words: the Ukrainian war, oil dependency, Russian energetic resources, EU energetic imports

J.E.L. classification: Q37, Q43, O52

1. Introduction

Energy has been an important and priority issue for the Member States of the European Union since the 1970s, more precisely because of the first oil crisis between 1973 and 1974. Since then, the EU has made great efforts and progress, while the EU single market has succeeded in providing access to energy to all producers and customers. In addition, the EU has an interest in the sustainable use of energy, while energy supply has remained one of the most pressing challenges, especially in times of war and uncertainty, such as the war in Ukraine.

Against the backdrop of Russia's invasion of Ukraine, there is a growing need for many member states in Europe to end their dependence on Russian energy resources. The EU's energy needs are estimated at about half of Russia's coal production, a quarter of its oil production and about 40% of its natural gas (Rudakov, 2022). According to Roupas *et al.* (2009), the EU's vulnerability to oil increased between 1995 and 2007, while projections for 2030 indicate two scenarios, depending on oil prices. While a high oil price will lead to an increase in European vulnerability, a low price will lead to a decrease in EU oil vulnerability to the same level as in 2005. Acevedo and Lorca-Susino (2021) suggest that the European Union is still dependent on supplies from Russia, despite European efforts to promote bioenergy and alternative forms of energy. Braun *et al.* (2023) confirm that European countries are dependent on Russian energy resources, while the conflict between Russia and Ukraine causes smaller economic consequences for post-Soviet countries, even though these economies have the largest exposure to Russia. For Cappelli and Carnazza (2023), the EU's major problem is its dependence on oil, which has led to geopolitical dependence, more pronounced recently in the context of the war in Ukraine.

Considering these aspects, the aim of this paper is to highlight the differences between the European Union countries in terms of energy dependence on conventional resources. This has achieved by grouping EU countries according to their energy dependence through a composite instrument applied for the period 2014-2022. Using such a tool facilitates the process of understanding the changes taking place in energy security and energy dependence at EU level. Moreover, this research can help to see the links between different dimensions of energy dependence and the degree to which certain components of energy dependence influence others. Furthermore, the paper has the merit of synthesizing an enormous amount of information in a format that facilitates quick comparisons between the EU Member States.

2. Literature review

The literature is rich in studies on the EU's energy dependence. However, most studies focus on theoretical approaches and only a small number of studies provide the necessary statistical tools to quantify this dependence. Most of these studies use a composite index as a measure of vulnerability or energy dependence (Table 1).

Table no. 1. The literature for measuring the EU's energy dependence

Author	Statistical tools	Limitations
Gupta (2008)	Composite index using Principal Component Analysis (PCA)	Refers only to oil vulnerability; the analysis is static (for 2004); must consider more factors and to incorporate the geopolitical risks.
Gnansounou (2008)	Composite index using Euclidian distance	Limited compensation between scores; subjective weighting of index; the analysis is static (for 2003)
Roupas et al. (2011)	Composite index using PCA	The analysis is static (for 2006); need a more dynamic environment and more variables
Cirovic et al. (2015)	Failure Mode and Effect Analysis (FMEA)	Does not consider Croatia,; the methodology does not precisely indicate the link between components
Gatto and Busato (2020)	Composite index using PCA	Equal weights for index, making the weighting rationale subjective.
Cappeli and Carnazza (2023)	Composite index using PCA	Focused only on oil dependency without implying oil vulnerability; they consider only five variables.

Source: (own processing)

Gupta (2008) is interested in oil vulnerability for 26 net oil-importing countries, including 16 EU member states, with Greece and the Czech Republic being the most vulnerable countries at the European level. Although his results are important for this topic, there are some limitations in terms of number of factors, static analysis and lack of geopolitical risks. Using the same methodology, Roupas *et al.* (2011) provide a comparative analysis of oil and natural gas supply, but their analysis is static (for 2006) and needs more variables. Gatto and Busato (2020) indicate that GDP is not a main driver of energy vulnerability. They use a composite indicator through PCA analysis for 265 OECD and non-OECD countries, including European ones, taking into account four dimensions of vulnerability (economic, governance, environmental and social). However, their methodology uses equal weights, which makes the weighting reasoning subjective.

On the other hand, Acevedo and Lorca-Susino (2021) provide a systematic analysis and descriptive approach to the EU's oil dependence as a threat to economic growth and diplomatic freedom. Cappelli and Carnazza (2023) measure oil dependence for EU-28 countries, combining four dimensions of oil dependence, including economic, energy, international and geopolitical dependence. The authors suggest that the notion of energy dependence is a less explored topic, while the literature focuses on oil vulnerability. However, their analysis focuses only on oil dependence, considering it the most used energy resource by EU member states.

Taking into account existing methodological limitations, Percebois (2007) suggests that the scientific literature needs statistical tools to measure both vulnerability and energy dependence, which include quantitative and qualitative variables. On the other hand, Cappelli and Carnazza (2023) indicate that the notion of energy dependence is a less explored topic, while the literature focuses on vulnerability to oil. They also point out that the scientific literature still needs a lot of research to understand the drivers of reducing the multidimensional dependency of EU member countries.

Considering the existing results in the literature, the main contribution made by this paper aims to analyze the current energy crisis at the European level by grouping the EU countries according to the level of energy dependence through a composite tool applied for the period 2014-2022. The index has the merit of capturing the energy security performance of EU countries in the context of the Russia-Ukraine conflict, taking into account the lack of comparative studies between EU countries on energy dependence across a wide range of determinants of energy dependence. Moreover, given the major changes in the world economy because of the war in Ukraine, such a comparative study is particularly important. The proposed analysis is therefore a contribution to the literature.

3. Research methodology

Methodology implies a composite index on energy dependence using Principal Component Analysis (PCA) for period 2014-2022, designed to cover the outbreak of the conflict between Russia and Ukraine in the context of the annexation of the Crimean Peninsula (2014) and culminating in the declared war between the two in early 2022. The construction of the composite index is based on 23 indicators from major statistical databases, including the World Bank and the European Commission (Eurostat). The detail and description of the indicators used to construct the composite index are reflected in Table 2.

Table no. 2 Variables used

No.	Variable	Unit of measurement	Source
1.	Indigenous production of oil and petroleum products	Millions of tones	Ineligible
2.	Exports of oil and petroleum products	Millions of tones	Second pillar
3	Imports of oil and petroleum products	Millions of tones	First pillar
4	External balance on oil and petroleum products	Millions of tones	First pillar
5	Final consumption of oil and petroleum products	Millions of tones	First pillar
6	Indigenous production of solid fossil fuels	Millions of tones	Third pillar
7	Exports of solid fossil fuels	Millions of tones	Third pillar
8	Imports of solid fossil fuels	Millions of tones	First pillar
9	External balance on solid fossil fuels	Millions of tones	First pillar
10	Final consumption of solid fossil fuels	Millions of tones	Third pillar
11	Indigenous production of natural gas	Thousands of terajoules	Second pillar
12	Exports of natural gas	Thousands of terajoules	Second pillar
13	Imports of natural gas	Thousands of terajoules	First pillar
14	External balance on natural gas	Thousands of terajoules	First pillar
15	Final consumption of natural gas	Thousands of terajoules	First pillar
16	Imports from Russia (oil and petroleum products)	Millions of tones	First pillar
17	Imports from Russia (solid fossil fuels)	Millions of tones	Ineligible
18	Imports from Russia (natural gas)	Thousands of terajoules	First pillar
19	Coal rents*	% of GDP	Third pillar
20	Natural gas rents*	% of GDP	Second pillar
21	Oil rents*	% of GDP	Ineligible
22	Total natural resources rents*	% of GDP	Ineligible
23	GDP per capita at market prices	Thousands of euro	Ineligible

Source: Eurostat (2024); (*) The World Bank (2024).

The sample included 27 EU member countries, while the construction of the composite index considered the PCA, whose methodology is widely used in the literature. As presented in Table 1, many authors have used PCA composite indices to measure the energy independence of the EU. At the same time, this analysis is also used for other purposes, such as measuring quality of life (Dalton-Greyling and Tregenna, 2014), quantifying economic welfare (Dopke *et al.*, 2017), assessing economic resilience (Pintilescu and Viorica, 2019) or sustainable development at the European level (Barska *et al.*, 2020), the business environment (Topliceanu & Sorcaru, 2022) or the investment attractiveness (Sorcaru *et al.*, 2023). Nevertheless, this paper considers the methodology developed by Nardo *et al.* (2008, pp. 89-91) and the following statistical characteristics:

- Varimax rotation method;
- Fulfillment of three criteria in the selection of factor axes:
 - Kaiser's criterion, which requires eigenvalues to be greater than 1;
 - The individual contribution of each axis to explaining the total variance is greater than 10%;
 - The cumulative contribution of the axes considered to explain the total variance is greater than 60%.
- Selection of eligible variables with factor values greater than 0.7.

By constructing the composite index, it was possible to see which of the 23 indicators are the most significant in highlighting the energy dependence of the countries analyzed for the period 2014-2022. These indicators are grouped into main components (factorial axes), and the selection of these axes is made according to the three criteria listed above.

4. Findings

Applying PCA resulted in three eligible factor axes, whose values are presented in Table 3. The eigenvalues of these axes are greater than 3, the individual contribution of each axis exceeds 17%, and the cumulative contribution reaches about 78%. Therefore, the three criteria are met.

Table no. 3 Eligible factorial axes

Axis	Eigenvalues	Individual contribution	Cumulative contribution
1	11.409	43.123	43.123
2	3.848	18.163	61.286
3	3.008	17.070	78.356

Source: own processing.

Eligible indicators with factor loadings greater than 0.7 were selected at the level of each factor axis. Of the initial 23 indicators for which PCA was performed, only 18 were considered eligible, selected and normalized, about half of them being grouped in the first axis and four in each of the other two axes (Table 2). The three dimensions reflect the most important aspects of energy dependence for EU countries in the period 2014-2022. In other words, 18 indicators were statistically eligible, grouped in 3 pillars:

- Internal consumption and external supply (10 indicators);
- Self-supply capacity with natural gas (4 indicators);
- Self-supply capacity with solid fuels (4 indicators).

Considering the nature of the eligible variables and the number of factor axes, the three resulting dimensions have a different contribution to the composition of the aggregate index and to the grouping of EU countries according to energy dependence. The resulting positive values for the first dimension indicate a higher degree of energy dependence of the countries analyzed, while for the other two dimensions, the lower or negative values indicate higher energy dependence.

Table 4 shows the index scores for comparing EU countries for each dimension of energy dependence, but also for covering all three dimensions analyzed over the period 2014-2022.

Table no. 4 The EU countries ranked by energy dependence

EU country	First pillar	Second pillar	Third pillar	The energy (in)dependency index
Germany	1.168	0.507	0.244	0.472
Italy	0.462	0.148	-0.142	0.251
France	0.305	0.043	-0.236	0.209
Spain	0.079	0.028	-0.060	0.050
Slovakia	-0.101	-0.276	-0.133	0.037
Finland	-0.096	-0.249	-0.125	0.032
Belgium	-0.011	0.048	-0.176	0.021
Austria	-0.128	-0.244	-0.151	0.019
Latvia	-0.172	-0.322	-0.129	0.008
Hungary	-0.055	-0.125	-0.040	0.007
Luxembourg	-0.178	-0.328	-0.131	0.007
Lithuania	-0.148	-0.246	-0.142	0.006
Portugal	-0.156	-0.276	-0.126	0.005
Estonia	-0.177	-0.313	-0.127	0.003
Cyprus	-0.188	-0.328	-0.128	0.000
Sweden	-0.139	-0.185	-0.154	0.000
Malta	-0.191	-0.325	-0.126	-0.002
Ireland	-0.158	-0.198	-0.151	-0.008
Slovenia	-0.176	-0.308	-0.016	-0.022
Denmark	-0.105	0.049	-0.129	-0.041
Greece	-0.124	-0.149	0.058	-0.046
Croatia	-0.157	-0.020	-0.135	-0.052
Czech Rep.	-0.032	-0.289	0.576	-0.076
Bulgaria	-0.131	-0.277	0.442	-0.104
Poland	0.313	-0.030	1.390	-0.124
Romania	-0.093	0.511	-0.026	-0.164
The Netherlands	0.391	3.154	-0.127	-0.488

Source: own processing.

Ranking the index values by quartiles, the EU countries have been grouped into four dependency categories. A high level of energy dependence is for countries with index values between 0.472 and 0.021, specific to countries such as Germany, Italy, France, Spain, Slovakia, Finland and Belgium. Thus, according to Table 4 and Figure 1, Germany is the most energy-dependent country, with an index value almost twice as high as the second most energy-dependent country, Italy.

Figure no. 1. The energy (in)dependency index



Source: own representation

At the same time, there is a secondary group of countries, including Austria, Hungary, Luxembourg, the Baltic countries and Portugal, whose index values range between 0.003 and 0.019 and are characterized by a moderate to high degree of energy dependence. A third group consists of island EU countries such as Cyprus, Malta and Ireland, together with Sweden, Slovakia and Denmark, whose values fluctuate between 0 and -0.041, indicating a moderate to low degree of energy dependence.

Last but not least, the best performing EU countries in terms of energy independence are Greece, Croatia, the Czech Republic, Bulgaria, Poland, Romania and the Netherlands, with index values ranging from -0.046 to -0.488. It is noteworthy that the score for the Netherlands is about three times lower than that of Romania, indicating a very low energy dependence for the Dutch economy.

5. Conclusions

The issue of energy supply has become an increasingly stressful priority for EU Member States, especially in times of war and uncertainty, such as the conflict in Ukraine.

The results of the analysis of the level of energy dependence of EU countries in the context of the war between Russia and Ukraine show that there are three dimensions of energy dependence for these countries, such as internal consumption and external supply, self-supply capacity with natural gas, and self-supply capacity with fossil fuels. Among the countries with a high degree of energy dependence, Germany, Italy and France have the highest values. Next follows the group of EU countries with a moderate to high level of energy dependency, the best performer being Austria. A group of six EU countries have a moderate to low energy dependency, with Greece, Croatia, the Czech Republic, Bulgaria, Poland, Romania and the Netherlands having a low energy dependency, with the Netherlands being the best performer at EU level in this respect.

A particular case is Germany, which despite having low values on the second dimension, in the end the energy dependency index shows it as the most energy dependent country among the EU countries. This result arises due to its high score on the first component. The explanation comes from the fact that the second dimension emphasizes own production and exports of natural gas, where Germany performed well in the period 2014-2022, while the first dimension encompasses domestic consumption and supply of energy resources through imports, especially from Russia, where the values were relatively high. Another explanation may stem from the fact that some of Germany's natural gas imports were no longer destined for domestic consumption but for export to other destinations within the EU. Even so, Germany remains one of the most energy-dependent economies in the EU. At the opposite pole, the relatively low index score of the Netherlands is largely due to its high natural gas self-sufficiency.

The differences in energy dependency between EU countries show that the EU's energy security objective should focus on renewable energy sources. From this perspective, measures in the field of nuclear energy or natural gas are necessary to avoid possible future energy crises at European level.

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The Cosmetics Industry in Romania: Analysis of Economic Performance and Trends

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Abstract

The cosmetics and personal care products industry have shown an upward trend recently, both globally and in Romania. The need for analysis of Romania's cosmetics sector is justified by highlighting socio-economic aspects due to changes in consumer behavior. In this context, the research involves analyzing statistical data on cosmetics manufacturing organizations in Romania, estimating consumption trends, and tracking the evolution of these organizations. The analysis shows that key indicators such as the number of manufacturers, turnover, and number of employees in Romania's cosmetics industry have increased. These values provide an overview of the sector's vitality, reflecting connections to changes in consumer habits.

Key words: cosmetics industry, economic performance, trends

J.E.L. classification: L11, L20, L25

1. Introduction

The paper aims to investigate the economic performance status in the cosmetics industry and manufacturers of personal care items in Romania, to offer insights into the sectors landscape.

In this context, we begin with an analysis of the European cosmetics and personal care market, that values €96 billion in 2023. The leading markets are: Germany (€15.9 billion), France (€13.7 billion), Italy (€12.5 billion), UK (€11.0 billion), Spain (€10.4 billion), and Poland (€5.2 billion) (Cosmetics Europe, 2024).

The demand for natural cosmetics and for products meeting sustainability standards is increasing according to recent trends. Socio-demographic characteristics are shaping the consumer preferences and are suggesting the adoption of recent values in consumption trends. The frequency of using skincare products has increased, leading to a rise in the amounts spent on this category of goods (Mitterer-Daltoé et al., 2023).

According to the data presented in the Socio-Economic Contribution of the European Cosmetics Industry brochure (Cosmetics Europe, 2016), there were over 5,000 cosmetic manufacturers in Europe, most of which were SMEs with fewer than 10 employees.

The value chain of the cosmetics industry includes five elements:

1. Organizations that manufacture cosmetic ingredients, packaging and industrial design research and development - providing inputs for producers;
2. Organizations producing cosmetics;
3. Distribution and wholesale organizations;
4. Organizations offering beauty services and retailing cosmetic products;
5. End consumers.

In the 2012-2013 period, the direct contribution to the Gross Value Added (GVA) in the European economy of the cosmetics industry in Europe was of approximately €8.09 billion annually. Regarding distribution and wholesale organizations, they have an indirect impact on the indicator, quantified at €21.18 billion. The total contribution of the cosmetics industry to GVA in Europe is €29.27 billion. The industry directly and indirectly supports over 2 million jobs, of which 152,000 are in

manufacturing organizations.

As a member state of the European Union, in Romania the cosmetics industry sector is being governed by EU cosmetics legislation (Regulation (EC) No 1223/2009 of the European Parliament and of the Council of Europe of November 30, 2009, on cosmetic products (recast) and CosIng - Cosmetic Ingredients Database), concerning:

- Good manufacturing practices,
- Compliant use of cosmetic ingredients:
 - purity of ingredients;
 - safety measures regarding substance concentrations;
 - prohibition of using substances considered dangerous to human health, animal testing (cruelty-free cosmetics, which involves organizational ethics and responsibility);
 - purity of materials from which containers are obtained - due to possible interaction of the cosmetic product with primary packaging (possible contamination) and for sustainability reasons;
 - existence of certificates of conformity for ingredients and containers (ensuring traceability); compliant labeling of packaging.

Of course, these are just a small part of the provisions of the cosmetics legislation. The legislation is extensive, and although necessary, it can represent an external threat factor for small organizations. Implementing a business plan in this sector requires researching legislation and analyzing the feasibility of starting of operations. Given the share of SMEs in the sector, we note that aligning small and medium-sized producers with EU standards includes significant aspects related to:

- licensing activities;
- compliant arrangement of production, storage, and auxiliary spaces;
- investments in operational levels: production line, packaging, storage of finished products;
- professional training of operators;
- high production costs: low bargaining power with suppliers, expensive raw materials, and sometimes difficult to acquire due to scarcity, risk of stockouts, etc.

2. Literature review

This article is also taking into account the analysis of the economic indicator turnover. The turnover is defined as “the sum of revenues generated from the sale of goods, sales of merchandise, execution of works, and provision of services, minus waste, rebates, and other discounts granted to customers” (Moroşan, 2006). This indicator reveals financial performance and operational efficiency. The turnover can be used to calculate key indicators in financial management, while its dynamic can indicate the stability of the market position.

Building on the definition by authors Schiffman and Kanuk (1997 cited in Roy and Datta, 2022, p. 208), who define consumer behavior as “the behavior that consumers display in search of obtaining, using, assessing, and rejecting products, services, and ideas”, and considering that “the cosmetics industry is an ever-expanding industry, driven by science, innovation, and creativity, which has made huge investments in R&D globally” (Turcu and Brancu, 2023), we are focusing on the evolution of the cosmetics industry in Europe, transitioning to the Romanian industry. Regarding R&D, at least 33 innovation and research facilities in the cosmetics sector have been identified in Europe (Cosmetics Europe, 2016). This figure suggests a strong interest in the industry's development, in line with the demand.

Relevant factors impacting the population and driving them to purchase and consume cosmetic products include:

1. Economic factors: The largest customer segment is primarily represented by financially independent women, leading to an increase in the consumption of premium, luxury, or natural products;
2. Socio-psychological factors: The culture they belong to, the need for personal care, the desire to show their status in the society, as well as self-esteem-based factors (Dubois et al., 2020).

The evolution of this sector, both in general as well as in Romania, has been primarily influenced by legislative, economic, and consumer trend factors. Studies (Kumar, 2005) reveal that consumer trends include aspects such as:

- increased demand for natural products,
- the customization of products,
- "multifunctional" care products,
- the impact of sustainability and eco-friendly packaging (including the return of the packaging for refill),
- the search for "holistic" personal care products,
- increased demand for anti-aging and derma cosmetics products.

The idea of sustainability is also highlighted by Abrudan and Tatu (2019), who assert that manufacturing organizations have formulated objectives regarding environmental protection. These objectives are being achieved through the implementation of business practices that minimize their environmental impact by using natural and organic substances as well as biodegradable and recycled materials.

3. Research methodology

The research utilizes datasets from the public annual reports of the National Institute of Statistics (INSSE). The analysis is quantitative in nature and focuses on the 2015 to 2022 timeline. The dataset available at the industry level refers to active economic agents categorized by their main activity, according to the classification code from the National Economic Activity Classification in Romania, 2042 - Manufacturing of perfumes and cosmetic products, as follows:

1. The number of organizations by size, according to the classification: micro-enterprises, SMEs, and large enterprises;
2. Average number of employees by organization size- necessary for evaluating the workforce and its evolution from the employment perspective;
3. Turnover by organization size- an indicator necessary for assessing the financial performance of economic agents.

The data allows for an analysis of the evolution of the cosmetics industry in Romania and provides insights into recent trends.

4. Results and discussions

The analysis of data from the 2015 - 2022 period shows the dynamics of the number of organizations in the cosmetics industry (CAEN 2042) in Romania, categorized by size, according to table no. 1.

Table no. 1 The number of organizations with CAEN 2042 from Romania by size classes, 2015-2022

Organizations with CAEN 2042 from Romania by size classes	Number of organizations							
	2015	2016	2017	2018	2019	2020	2021	2022
0-9 employees	81	88	108	139	171	182	181	184
10-49 employees	13	14	15	15	16	15	11	11
50-249 employees	2	2	2	2	2	2	2	2
250 employees +	1	2	2	2	2	2	2	2
Total	97	106	127	158	191	201	196	199

Source: INSSE

The findings regarding the industry are as follows:

- There is a notable increase of 127.16%, from 81 organizations with 0-9 employees in 2015 to 184 in 2022, which numerically dominates the industry, suggesting that, in response to increasing demand, a significant number of start-ups and small businesses have been established;

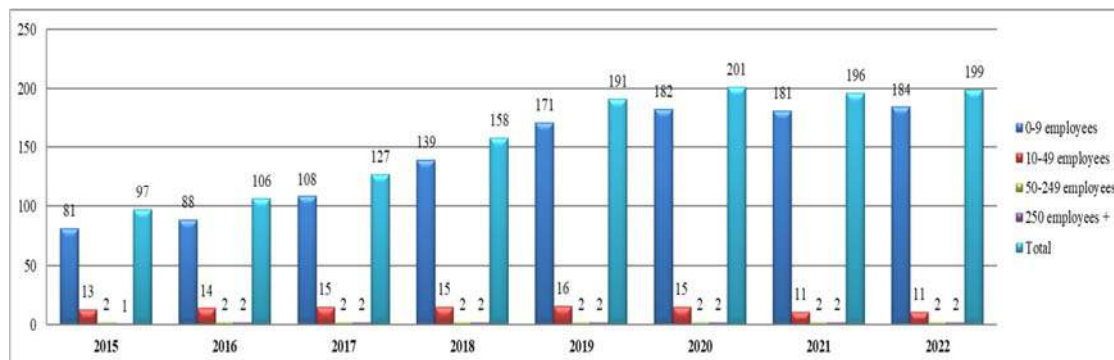
- For organizations with 10-49 employees, there is a slight increase from 13 in 2015 to 16 in 2019 (23.07%), but this number decreased to 11 in 2022, representing a decline of 15.38% compared to 2015. We interpret this fluctuation as limited consolidation of businesses, facing difficulties in maintaining competitiveness;

- The number of organizations with 50-249 employees remained constant at 2 organizations throughout the analysis period. The stability of this category indicates that few firms have managed to consolidate to medium size, which may indicate existing barriers in the specific business environment;

- The data shows that during the analyzed period, in the category of organizations with over 250 employees, the number doubled from one manufacturer to two, a 100% increase from 2015 to 2016. The number remained at 2 manufacturers for the rest of the analysis period, suggesting a limited presence of large companies in the cosmetics industry in Romania.

In figure no. 1, it is evident that in the 7 years of analysis, the market for cosmetic manufacturers has expanded, with the total number of organizations increasing from 97 in 2015 to 199 in 2022, representing a growth of 105.15%, a factor that influences market share. The majority of small enterprises remain in this category, facing difficulties in scaling up to medium or large organizations.

Figure no. 1 The evolution of the number of organizations with CAEN code 2042 in Romania



Source: INSSE

In table no. 2, the evolution of the average number of employees for each organization category during the period 2015 - 2022 can be observed. Based on this data, we conclude that:

- in organizations with 0-9 employees, the average number of employees temporarily increased from 155 in 2015 to 263 in 2020, representing a growth of 69.67%. Between 2020 and 2022, there was a decrease in this parameter by 9.12%;

- following a similar trend in the previous category, in organizations with 10-49 employees, we notice an increase in the average number of employees from 265 in 2015 to 364 in 2020, a rise of 37.35%;

- however, from 2020 to 2022, there was a decline from 364 to 244, a decrease of 33.15%. The average number of employees in 2022 is 7.92% lower compared to the reference year of 2015;

- unlike the previously analyzed categories, organizations with 50-249 employees and those with over 250 employees did not record decreases in the average number of employees in 2020; on the contrary, their employee numbers increased compared to the period from 2015 to 2019. Organizations with 50-249 employees had, on average, 14.28% more employees in 2022 compared to 2015, while those with over 250 employees experienced an increase of 84.29%.

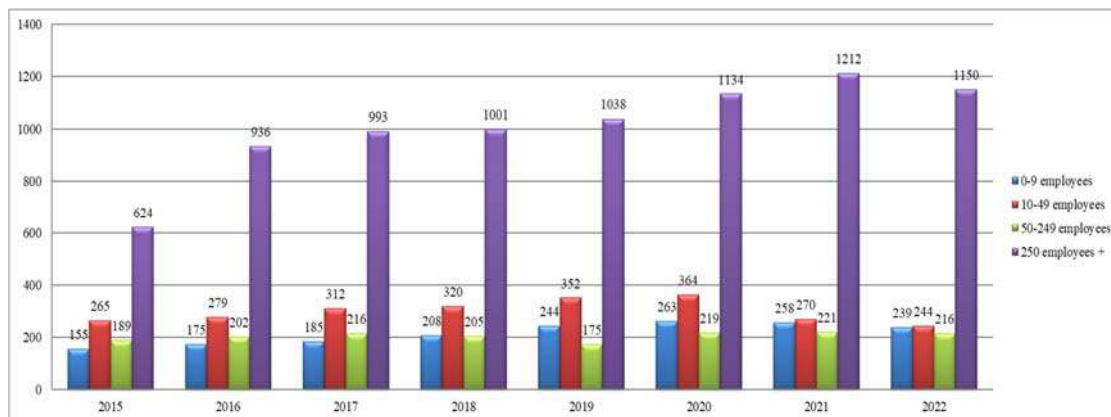
Table no. 2 The average number of employees in organizations with CAEN 2042 from Romania by size classes, 2015-2022

Organizations with CAEN 2042 from Romania by size classes	Average number of employees							
	2015	2016	2017	2018	2019	2020	2021	2022
0-9 employees	155	175	185	208	244	263	258	239
10-49 employees	265	279	312	320	352	364	270	244
50-249 employees	189	202	216	205	175	219	221	216
250 employees +	624	936	993	1001	1038	1134	1212	1150
Total	1233	1592	1706	1734	1809	1980	1961	1849

Source: INSSE

In figure no. 2, we can observe that organizations with 0-9 employees and 10-49 employees, although numerous in the market, have recorded decreases in the average number of employees since 2020, indicating a limited ability to survive and adapt to the external environment. This period coincides with the COVID-19 health crisis, during which the number of employees decreased in certain areas of activity. On the other hand, organizations with 50 to 250+ employees have seen increases in the average number of employees from 2015 to 2022.

Figure no. 2 The evolution of the average number of employees in organizations with CAEN 2042 in Romania by size categories, 2015-2022



Source: INSSE

The analysis of the turnover indicator shows an upward trend at the industry level, according to table no. 3 and graphically represented in figure no. 3. The values are expressed in euros, obtained by dividing the values provided by INSSE by 5000, considering an exchange rate of 1 euro = 5 lei. In the group of organizations with 0-9 employees, we observe an increase in turnover from €4.06 million in 2015 to €10.30 million in 2022, representing a growth of 153.69%. The year 2018 is marked by a decrease. Starting from 2019, the turnover increases year by year, with a rise of 38.78% in 2019, 32.10% in 2020 compared to 2019, 32.10% in 2021 compared to 2020, and 31.04% in 2022 compared to 2021.

Table no. 3 The turnover of the organizations with CAEN 2042 from Romania by size classes, 2015-2022

Organizations with CAEN 2042 from Romania by size classes	Turnover (mil. EUR)							
	2015	2016	2017	2018	2019	2020	2021	2022
0-9 employees	4.06	4.69	5.54	4.28	5.94	5.95	7.86	10.30
10-49 employees	10.20	11.21	14.96	17.42	18.97	22.71	21.38	17.06
50-249 employees	10.06	11.70	13.69	13.89	14.72	15.48	16.46	16.68
250 employees +	34.50	58.41	63.01	68.46	77.22	90.54	98.79	111.39
Total	58.82	86.02	97.20	104.05	116.86	134.67	144.49	155.43

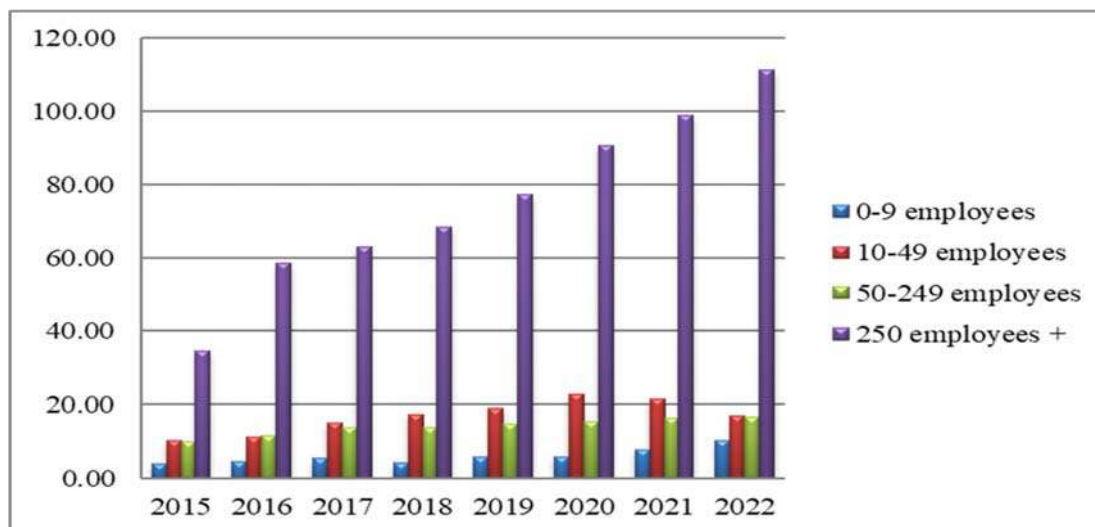
Source: INSSE and calculations made by the author

The results show a relatively constant growth, indicating that organizations are solidifying their positions in the market. This evolution may suggest a focus on certain market niches. From the empirical study, it can be observed that the majority of such organizations are 100% natural cosmetics producers, satisfying the demands of trends like veganism, environmental sustainability, and holistic care.

Organizations with 10-49 employees register an overall increase in turnover during the analysis period, rising from €10.20 million in 2015 to €17.06 million in 2022, which is an increase of 67.25%. We notice that in 2021 and 2022, the turnover decreased as follows: from 2020 to 2021, it dropped by 5.86%, and in 2022, it recorded a decrease of 20.20% compared to 2021.

The financial results of organizations with 50-249 employees increase steadily, without major fluctuations, year by year. In 2022, they recorded a turnover that was 65.80% higher than in 2015. The situation of this category of organizations is characterized by stability.

Figure no. 3 The evolution of turnover in the cosmetics industry in Romania, during the period 2015-2022



Source: INSSE and calculations made by the author

Organizations with over 250 employees experience the highest turnover growth, at 223.74% in 2022 compared to the reference year of 2015, rising from €34.50 million to €111.39 million. Among all categories of organizations, showing accelerated growth year after year, particularly notable results occurring between 2020 and 2022. In 2022, units with over 250 employees reported a turnover of €111.39 million, surpassing the combined results of all other categories of units, which totaled €44.04 million. This represents a relative increase of 252.93%.

To correlate the turnover of these organizations with the demand for cosmetic products, we considered the average monthly income per person and average monthly expenditures per person in Romania. According to table no. 4, both the population's income and expenditures have increased. However, we focus on the surplus funds available for savings and investments. This surplus can be directed towards the purchase of cosmetic products and meeting personal needs, including for well-being and for boosting self-esteem.

Table no. 4 The evolution of income, expenses/person (lei), 2015-2022

Indicators	2015	2016	2017	2018	2019	2020	2021	2022
AMNI /person (lei)	1859	2046	2338	2642	2986	3217	3416	3801
TAME /person (lei)	884.56	953.4	1093.9	1406.84	1582.7	1701.77	1924.87	2235.1
AMAR /person (lei)	974.44	1093	1244.1	1235.16	1403.3	1515.23	1491.13	1565.9

Source: INSSE

Where:

AMNI-Average monthly net income; TAME-Total average monthly expenses; AMAR-Average monthly amounts remaining/person

During the analyzed period, revenues showed an upward trend, increasing from 1,859 lei in 2015 to 3,801 lei in 2022, representing a growth of 204.47%. Expenditures followed a similar trend, rising from 884.56 lei in 2015 to 2,235.1 lei in 2022, marking a 252.68% increase. Notably, the growth rate of expenditures (252.68%) outpaced that of revenues (204.47%).

The difference between revenues and expenditures represents a reserve that can be allocated to various activities, including the purchase of cosmetic products. This budget surplus amounted to 974.44 lei in 2015 and increased to 1,565.9 lei in 2022, reflecting a growth of 160.7%.

Although the surplus exhibits an upward trend in absolute terms, its relative growth rate is lower than that of revenues and expenditures, demonstrating the slowest increase among the three indicators.

5. Conclusions

Following the interpretation of the previous data, we find that the economic performance of the cosmetic products sector shows consistent growth for all types of units and for all parameters analyzed.

Regarding the increase in demand for anti-aging and derma cosmetic products, the categories of organizations that meet these needs are those with 50-249 and 250+ employees. According to table no. 3, the turnover of these two categories of organizations suggests that financial strength is a strong point for them, which supports research and development activities. The market reveals that these categories of products are not accessible to every manufacturer. The costs of bringing these products to market are high, as they involve testing on human subjects, physicochemical testing, large quantities of raw materials, and rare or premium raw materials, etc.

In correlation with the economic performance of organizations and the recorded trends, we believe that psycho-social and economic factors will contribute to the increase in cosmetic product consumption through measures such as: the level of education, concern for well-being (including among young people and individuals over 60), the rise in income, and facilitating access to credit banking products.

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EU-US Transatlantic Partnership in the Context of Global Competition

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Abstract

Historically, the "partnership" between the EU and the USA has unfolded on multiple levels - economic, technological, social, cultural, and strategic - and is rooted in shared values such as democracy, fundamental rights, and the rule of law. Multilateral forums, especially NATO, strengthen this bond. The core strength of transatlantic relations lies in the deep economic integration between the two major economies, reflected in robust trade and mutual investments that benefit both. This paper focuses on the economic and financial aspects and their impact on the partnership. EU-USA cooperation's shared values and mutual benefits outweigh their occasional disagreements or misunderstandings. Therefore, signing a comprehensive collaboration in the future (not merely a sequential or sectoral one) should be a priority for both parties. Will Trump agree?

Key words: EU-USA, economic integration, international relations, partnership.

J.E.L. classification: F02, F15, O11, Y10

1. Introduction

In this paper, we aim to analyze the EU-US relationship and argue particularly from an economic perspective the necessity, opportunity, and importance of establishing an extensive and sustainable transatlantic partnership, which is essential for both parties. We will present the current context, particularly emphasizing the advantages/benefits of the partnership for both sides, with the analysis focusing primarily on the socio-economic aspects of the studied relationship. To begin with, we will conduct a literature review, and then the demonstration will be based on a quantitative approach.

In essence, the originality of this paper lies in its comprehensive analysis of the EU-US partnership from a multi-dimensional perspective, its focus on economic integration, and its emphasis on future collaboration amidst changing political dynamics, offering theoretical contributions and practical implications for the relationship.

2. Literature review

According to the statements of the U.S. Embassy in Romania, the launch of negotiations for the transatlantic partnership for trade and investment dates back to 2013, being announced by the sitting presidents at that time, Obama (USA), and from the EU, Van Rompuy (President of the European Council) and E. Barroso (President of the European Commission).

Unfortunately, the transatlantic trade partnership was blocked during Trump's first term. Thus, we can mention: the Airbus-Boeing dispute, the U.S. tariff threat on European cars, or the French tax on digital services, as well as the future of the WTO, which represented some of the concerns for the EU-U.S. relationship, which was at a difficult moment, perhaps the most tense since 2003 (the Iraq war, another moment of serious disputes among allies). Perhaps the most frustrating for Trump was

the management of the trade deficit situation between the parties (especially regarding goods trade), to the detriment of the U.S., so Trump was an advocate of the so-called "managed trade," whereby the EU would commit to predetermined export restrictions or certain purchase commitments, which, in reality, the EU would not agree to (and rightly so, as market distortions through government interventions have nothing to do with the idea of a free market). Another point to note is that although cooperation on standards would have been extremely useful, especially as technological competition between the U.S. and China intensified, this point did not take center stage in the negotiations regarding the future of transatlantic trade. For the future, T. Gehrke (2020) understands that resetting the transatlantic relationship will require a more integrated approach to trade, technology, and security.

After the victory of Biden's Democrats in 2020, European leaders, through Ursula von der Leyen and J. Borell, announced a new transatlantic agenda in Brussels on December 2, 2020. This is aimed at global cooperation based on common values and interests, addressing issues such as the COVID-19 pandemic, environmental protection, prosperity, peace, and security. The agenda also included collaboration in technology, trade, and standards, such as the reform of the WTO and the creation of an EU-US Trade and Technology Council. This reflected the EU's vision for rebuilding the transatlantic relationship (European Commission, "EU-US: A new transatlantic agenda for global change", 2020).

With the assumption of office by the Biden administration, a reset of relations between the EU and the US regarding multilateral cooperation, which had stagnated during Trump's term, was anticipated. This new agenda was subsequently adopted by both the US and the EU during the EU-US Summit in the summer of 2021, indicating a shift from Trump's predominantly bilateral approach to international relations, state to state. Progress has been made in some areas, particularly due to the ongoing war in Ukraine, which has united allies. However, there have also been tensions in transatlantic relations, starting with the US withdrawal from Afghanistan, initially negotiated by Trump, which Biden agreed to, despite European concerns about instability. Another friction point arose from the AUKUS agreement between Australia, the United Kingdom, and the US for nuclear-powered submarines, which led to the cancellation of a 56 billion euro contract with France for diesel-electric submarines, causing a diplomatic conflict. The US decisions regarding Afghanistan and AUKUS may reflect its desire to support the UK in offsetting the losses caused by Brexit (Volintiru & Drăgan, 2019).

Then, another reason for contradictory discussions was the Nord Stream 2 gas pipeline from Russia to Germany, with Biden ultimately being convinced by German Chancellor Merkel to allow the continuation of the pipeline's construction, in exchange for the promise that Germany would exert pressure for EU sanctions against Russia if it were to use energy supply as a weapon against other countries. Biden's approval came despite the consensus in the US Congress that the pipeline would affect European security and ignoring the opposition of several European states (which are loyal to the US) against this project, Nord Stream 2. On the other hand, Biden had to prove that he was ready to listen to the sensitive issues of Europeans if he wanted support from the EU bloc regarding American concerns about the threat of China's expansion (which involves agreements among allies on trade policy, establishing common international standards, preventing the transfer of sensitive technologies, etc.). At the same time, Biden had to ensure that the US was not fueling divisions among European states, but rather the opposite. In this context, the European Parliament, in October 2021, called for a partnership among equals, respecting the strategic autonomy of the EU. It is equally true that not all EU countries agreed on the limits of this autonomy, a relevant example being in the field of common defense and security, a subject we will not detail, as it exceeds the proposed analysis.

According to Lišanin (2021), the new Biden administration has failed to make significant progress in strengthening transatlantic ties, with many of the issues being more structural.

De Bièvre & Poletti (2020) offer insights into the varying degrees of politicization in EU trade agreement negotiations over the past decade, considering factors such as salience, polarization of public opinion, and the growing involvement of various actors.

Buthe (2021) argues that commercial relations, scientific collaboration, joint initiatives by non-governmental think tanks, and private networks can all significantly contribute to the renewal of the transatlantic partnership.

From Avar & Lin (2021), we note that transatlantic burden-sharing relations are becoming increasingly important. However, the EU still lacks sufficient political and military capacity to address international issues with a unified voice. Both the U.S. and the EU must make efforts to strengthen their relationship.

The 2022 analysis from the Center for European Policy highlights key global issues, including transatlantic relations, China, Russia as a security threat, and the Russia-Ukraine war, and how they affect the EU's global role. The authors noted that 2022 would be a challenging year for the EU, particularly in US-EU relations, with outcomes dependent on geopolitical instability, including elections and leadership changes. Global trends like climate change, digitalization, and the decline in democracy also shape EU policy. Unlike the Trump administration, Biden's re-engagement with multilateral forums was seen as positive, though disagreements persisted on several issues, such as Afghanistan and trade. Biden worked to address these, rebuilding ties with France and reaffirming US commitment to Europe.

The context in which the resetting of transatlantic relations is being discussed is the increasingly intense global competition between the U.S. and the emerging superpower China, with American policy toward China maintaining the same hostility under Biden's administration. Ahead of the U.S.-EU summit in June 2021, the preparatory documents for the event—the "Cyber Diplomacy Act" and the "Democracy Technology Partnership Act" from the U.S. Congress, as well as "The New EU-U.S. Agenda for Global Change", a joint communication from the European Parliament, the European Council, and the Council, outlined the interests of both parties.

From a technical perspective, the outcome of the 2021 EU-U.S. Summit was the establishment of the EU-U.S. Trade and Technology Council (TTC). Its primary objectives included enhancing trade and investment cooperation in emerging technologies, strengthening technological and industrial advancements, establishing common technological standards, promoting digitalization, and rebalancing production and supply chains (particularly for semiconductors), all while respecting each side's regulatory autonomy. Politically, the summit underscored the alignment of shared values between the two open societies, including support for democracy, fundamental freedoms, and respect for privacy. This alignment emphasized the need for cooperation in setting global rules and technological standards, especially in light of the challenges posed by China.

Csernaton (2021) argues that technological innovation, as a crucial element of international cooperation, should be at the heart of a new phase of cooperation and trust between the EU and the US.

Authors Jungmittag, & Welfens argued (2020) that the international economic debate on the Transatlantic Trade and Investment Partnership (TTIP) focused mainly on the financial gains resulting from trade, while the benefits associated with foreign direct investment (FDI) and innovation have been largely neglected. In addition, they criticized the protectionist policy implemented by the Trump administration.

According to author Loy, the first TTC meeting took place in September 2021.

The TTC is structured around 10 thematic working groups [The 10 thematic working groups are: (1) Technological standards, (2) Climate and green technologies, (3) Securing production chains (especially for semiconductors), (4) Securing and competitiveness of ICT, (5) Governance of data and technological platforms, (6) Inefficient use of technology and human rights, (7) Export controls, (8) Foreign investment verification, (9) Promoting SMEs' access to digital technologies, and (10) Addressing global trade challenges (source: European Commission)

On the other hand, according to Leclerc & Hagemann (2021), the private sector also provided positive support for these initiatives, recognizing that deeper cooperation through the establishment of rules and regulations (including measures for securing specific platforms) would lead to better economic integration, benefiting both parties.

Sharikov (2022) argues that the growing cooperation between the U.S. and the EU reflects a counterbalance in the global competition between U.S.-led Western democracies and Chinese-led Asian autocracies. Additionally, Russia's military actions in Ukraine have further driven transatlantic relations.

3. Research methodology

The research aims to answer the question: "Is the EU-US partnership vital? Or can the two major actors manage without it?" To this end, we will employ a combination of research methods: a comprehensive literature review and quantitative analyses through collecting and processing relevant statistical data, and pertinent comparative evaluations.

More specifically, we proposed an analysis of the GDP (in various expressions) in aggregated values and as a percentage of the total world for the main powers (USA, EU, China, Russia) in the period 2000-2022, as well as in a condensed format for the period 2019-2022. Subsequently, an analysis was conducted on the trade in goods and services of the major global powers in 2022. Additionally, we analyzed the EU's trade relations with other superpowers (2021), bilateral foreign investments (2020), and the FDI flows of the EU and the US relative to the global totals (2022).

The primary sources of the collected data are Eurostat and the World Bank (WB).

4. Findings

To better understand the EU-US relationship, we propose a comparative analysis of economic power (real GDP at PPP in USD) and trade flows between major superpowers (EU-US, EU-China, EU-Russia). The GDP data is summarized for the period 2019-2022 in Table 1 (green↑, red↓).

Table no. 1 Real GDP at purchasing power parity (PPP), national (bill. \$) or per capita (\$), 2019–2022

real GDP (constant, 2017), purchasing power parity (PPP), billion dollars (\$)	year 2019	year 2020	year 2021	year 2022	Σ (2019-2022)	%
USA	20511	19943	21129	21538	83,121.00	15.64
China	22493	22996	24939	25684	96,112.00	18.08
EU	19850	18742	19860	20569	79,021.00	14.87
Russia	4000	3894	4112	4027	16,033.00	3.02
WORLD	130662	126785	134789	139322	531,558.00	100.00
real GDP (constant, 2017) / capita, PPP, USD (\$)	year 2019	year 2020	year 2021	year 2022	AVERAGE (2019-2022)	%
USA	62471	60159	63636	64623	62,722.25	370.59
China	15978	16297	17658	18188	17,030.25	100.62
EU	44371	41824	44413	45978	44,146.50	260.84
Russia	27255	26581	28057	27450	27,335.75	161.51
WORLD	16878	16212	17087	17523	16,925.00	100.00

Source: (World Bank database, July 2024)

In terms of *real GDP (constant, 2017, bill. \$) at purchasing power parity*, China has surpassed the USA since 2016 (Source: WB), with China being the country with the fastest economic growth rate. Regarding GDP per capita, the USA and the EU far exceed the other analyzed competitors, which speaks volumes about the high average value of the individual standard of living.

The evolution of *real GDP* over a long time series from 2000 to 2022, expressed in aggregate values (billion \$) at constant 2015 prices, represents an important analysis for understanding economic growth and the economic shares among global powers (Table 2).

Table no. 2 Real GDP (constant 2015, billion USD), in aggregate values, 2000-2022

real GDP (constant, 2015) billion dollars USD	Σ (2000-2022) billion dollars USD	% of total (2000-2022)
USA	392471	25.17
CHINA	199595	12.80
EU	302280	19.39
RUSSIA	28378	1.82
World	1559303	100.00

Source: (own elaboration by authors based on WB database, July 2024)

In Table 3, we present some relevant data about international trade in goods and services (data collected and processed from the World Bank and Eurostat databases, converted where applicable into USD), in billions of USD, for the year 2022, from which it results that the EU is the largest market in the world, and consequently the most attractive one.

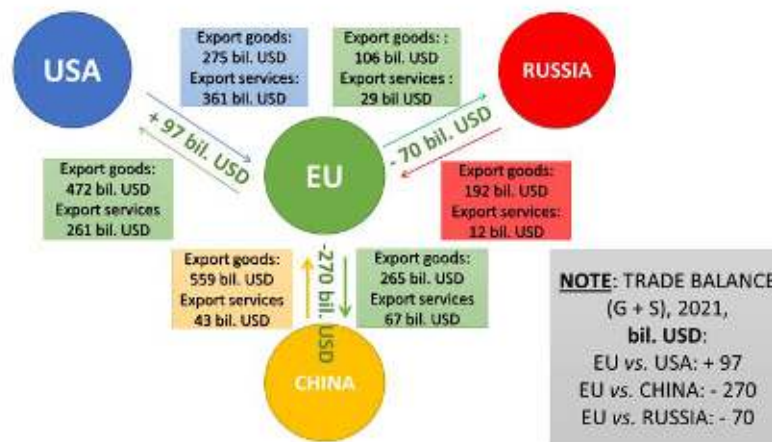
Table no. 3 Trade in goods and services, 2022

Trade in goods and services, 2022 (BoP, current USD)	Export of goods and services, bil. USD & (%)	Import of goods and services, bil. USD & (%)	Trade balance, G+S (Exp - Imp), bil. USD
CHINA	3716 (11,8%)	3139 (10,2%)	576
RUSSIA	641 (2%)	347 (1,13%)	293
USA	3018 (9,5%)	3970 (12,9%)	-951
EU (total, intra+extra EU)	9446 (29,9%)	9114 (29,6%)	332
EU extra-Community trade, G+S, with non-EU countries	Missing Eurostat data for services 2022	Missing Eurostat data for services 2022	
Total global trade with goods and services	31605 (100%)	30820 (100%)	785

Source: (own elaboration by authors based on WB & Eurostat database, July 2024)

Bilateral trade (in billions of USD) between the major powers for the year 2021 is presented below.

Figure no. 1 Market integration (goods and services): European Union vs. 'Great Powers', 2021



Source: (own elaboration by authors based on WB & Eurostat database, July 2024)

The analysis of statistical data (trade flows), except for the pandemic period, shows that the EU and the USA form the largest trade partnership in history. In comparison, regarding trade relations with China and Russia, the EU has imbalanced trade relations, characterized by deficits and unhealthy dependencies, as demonstrated after Russia invaded Ukraine in 2022.

Foreign direct investments (FDI) are an essential component of the global economy, reflecting the level of economic integration and interdependence between countries.

To analyze the FDI situation, we will separately present the Inward Stock of foreign direct investments and the Outward Stock of direct investments abroad, focusing on the EU and the USA, their position in the global economy, as well as the bilateral flows between the EU and other major economies (USA, China, and Russia).

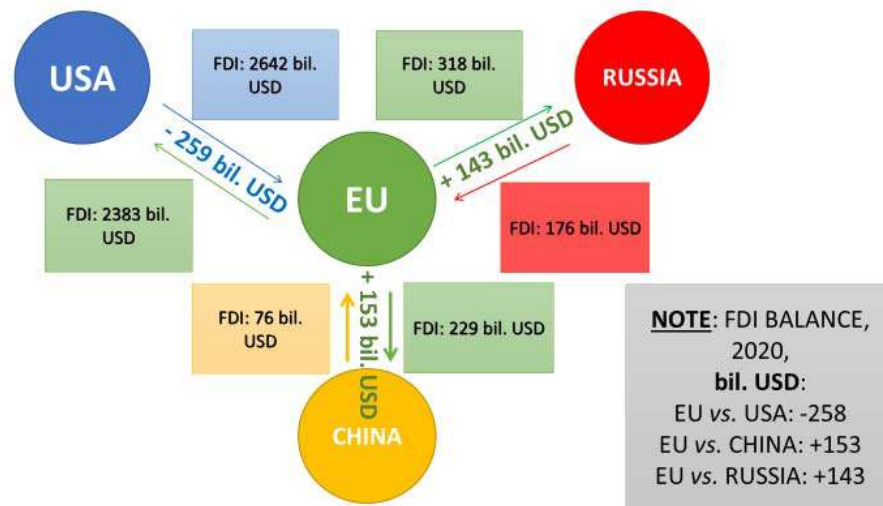
Table no. 4 Share of world FDI in 2022 (in USD billion and % of total)

	Inward stock	Outward stock
World in USD billion	44 252.759 (100%)	39 852.940 (100%)
EU	11 170.459 (25.24 %)	12 726.307 (31.9%)
United States	10 461.684 (23.64 %)	8 048.114 (20.19%)

Source: (European Parliament Directorate-General for External Policies of the Union calculations based on European Commission/Eurostat, 2024)

Regarding the level of bilateral foreign direct investments (in stocks, billions of USD), as of 2020, the situation is presented below, where the EU-US bilateral relationship is predominant (Fig. 2).

Figure no. 2 Bilateral foreign direct investment: European Union vs. 'Great Powers', 2020



Source: (own elaboration by authors based on Eurostat & Technical Sheets - European Parliament, 2024)

Here are some considerations about the current EU-US relationship (from an economic perspective):

- It is easy to see that the EU-US relationship in terms of trade flows, according to the latest available data (2021, Fig. 1), is developed and mutually beneficial, with an advantage for the EU; thus, in 2021, bilateral trade in goods reached 747 billion USD, while bilateral trade in services amounted to 622 billion USD, with the EU recording a surplus about the US, for total trade in goods + services, of +97 billion USD (a surplus of +197 billion USD from goods, and a deficit of -100 billion USD from services);

- According to World Bank (WB) statistics, the two regions together (EU + USA) account for over 40% of the global gross domestic product (GDP) and cover about 40% of the total international trade in goods and services;
- Furthermore, the US and the EU are the largest investors in the partner space: in 2020 (Fig. 2), total foreign direct investment stocks, summed bilaterally, reached 5025 billion USD, of which 2642 billion USD were American investments in the EU and 2383 billion USD were European investments in the US, resulting in a deficit of -259 billion for the EU. Since 2020 was a year of pandemic crisis with major restrictions that influenced economic results, we extracted relevant FDI data from 2019 (closer to a normal situation) – the data was converted to USD and shows the following (EU to US): 2374 billion USD and FDI (US to EU): 2243 billion USD, resulting this time for 2019 in a surplus balance for EU FDI compared to the US of +131 billion USD (European Parliament, Technical Sheets);
- According to the most recent official data from DG TRADE of the European Commission, foreign investments have created 9.4 million direct jobs in the US and the European Union, a point reinforced by Hamilton & Quinlan (2021), who stated that approximately 5 million jobs were created for each side. Indirectly, up to 16 million jobs may be supported. Total US investments in the EU are four times larger than in the Asia-Pacific region. EU foreign direct investments in the US are approximately ten times larger than EU investments in India and China combined (European Commission, EU trade).

5. Conclusions

At a global level, the two entities studied, the EU and the USA, together exceed 40% of the world's real GDP (or ~ 30% at PPP) and account for approximately 40% of total global trade in goods and services. The necessity and importance of establishing an extensive transatlantic partnership is undoubtedly evident from the presented socio-economic data.

Thus, the EU and the USA exhibit the largest bilateral economic integration in the world (see the volumes of reciprocal trade flows of goods and services and the reciprocal levels of FDI). Together we are stronger. As a result, the transatlantic partnership is vital for both partners.

In addition, the history that binds us, the common values, as well as the social impact through the jobs created as a result of massive mutual trade and investment activities cannot be ignored.

As regards the opportunity to establish an extensive partnership, the opportunity should have been taken advantage of during President Biden's term, the favorable determinants being, on the one hand, the Chinese threat (persistently signaled by the American side) and, on the other hand, the Russian threat, which, after February 24, 2022, led to the strengthening of relations between the allies.

What will happen in Trump's new term is hard to predict.

Limits of the study: The NATO analysis could provide another perspective, bringing EU member states that are also NATO members closer to the USA and vice versa. Additionally, data for the year 2023 for all indicators will be completed as soon as all data becomes available.

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The Global Trade-Sustainability Nexus: The Evolution of Sustainable Trade Index in the Period 2022-2024

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Abstract

Since its beginnings, trade has constituted an important economic activity, serving as a strong engine of change all over the world. Today's scale of global trade is unprecedented in economic history. As more and more countries, low-, middle-income and rich, have designed and implemented ambitious policies to promote sustainability in accordance with the United Nations Sustainable Development Goals, global trade should find solutions to these imbalances and adapt to these policies. The paper aims to briefly define the concept of sustainable trade and to expose the relationship between global trade and sustainability through the analysis of the evolution of the Sustainable Trade Index in the period 2022-2024. In order to accomplish the objectives of the paper, the author employed a qualitative scientific research method. The study enlarges the scientific literature related to the global trade-sustainability complex nexus and shows the increasing importance of sustainable trade at a global level.

Key words: global trade, trade, sustainability, Sustainable Trade Index, Sustainable Development Goals

J.E.L. classification: F1, F19

1. Introduction

Since its beginnings, trade has constituted an important economic activity, serving as a strong engine of change all over the world (Smith, 2008). During its long history, the trade of goods and services bridged not only human beings but also companies, countries and continents. The age of globalization that took shape in the 1990s (Cornescu *et al*, 2004) after the collapse of the communist regime was clearly associated with several important socio-economic achievements such as higher standards of living, trade liberalization and economic growth (Toma, 2005). The global trade contributes to worldwide prosperity because "it increases productivity by expanding the international division of labor... it enables export-led economic growth by providing access to foreign markets... it bolsters economic security by giving firms and households valuable outside options when negative shocks hit" (Georgieva *et al*, 2023, p.10).

Global trade is expected to reach almost US\$ 32 trillion (United Nations Conference on Trade and Development, 2024), a higher value than US\$ 30.5 trillion in 2023 (World Trade Organization, 2024). In 2023, China was, by far, the leading export country in the world, followed by the United States and Germany (Dywik, 2024) whereas the United States were the leading import country in the world, followed by China and Germany (O'Neill, 2024).

Thus, today's scale of global trade is unprecedented in economic history. It is stated that "trade in goods and services could be boosted, *inter alia*, by an increased uptake of digital services – including those related to artificial intelligence" (Attinasi *et al*, 2024, p.41) in the current Fourth Industrial Revolution (Toma *et al*, 2018). However, global trade brings both benefits and disadvantages. On the one hand, it allows countries to obtain economic gains through the exploitation of their comparative advantages. On the other hand, global trade leads to the relocation of industries to lower income countries and, therefore, to increasing environmental impacts (Wang *et al*, 2025). As more and more countries, low-, middle-income and rich, have designed and implemented ambitious policies to promote sustainability in accordance with the United Nations

(UN) Sustainable Development Goals (United Nations, 2015), global trade should find solutions to these imbalances and adapt to these policies.

The paper aims to briefly define the concept of sustainable trade and to expose the relationship between global trade and sustainability through the analysis of the evolution of the Sustainable Trade Index (STI) in the period 2022-2024. The remainder of this paper is structured as follows: Section 2 describes the theoretical background. The research methodology is illustrated in Section 3. Section 4 presents the findings. The conclusions are displayed at the end of the paper.

2. Theoretical background

Since the Fall of the Berlin Wall, the spread of the globalization process (Toma, 2013) has led to the rapid expansion of trade at a global level. Global trade, also known as international trade, represents:

- "the purchase and sale of goods and services by companies in different countries" (Heakal, 2024, p.1).
- "economic transactions that are made between countries" (Allais et al, 2024, p.1).
- "an exchange involving a good or service conducted between at least two different countries" (Corporate Finance Institute, 2024, p.1).
- "trade in products, services, etc. between different countries" (Cambridge Dictionary, 2024, p.1).

These definitions emphasize that global trade involves the deployment of economic transactions related to the purchase and/or sale of goods and/or services between countries.

On its turn, the concept of sustainability originated in the Brundtland Report (World Commission on Environment and Development, 1987). Starting from the idea that "a sustainable system is one which survives or persists" (Costanza *et al*, 1995, p.193), sustainability is interpreted in terms of three key dimensions, "which must be in harmony: social, economic and environmental" (Kuhlman *et al*, 2010, p.3438). It is defined as "the persistence over an apparently indefinite future of certain necessary and desired characteristics of both the ecosystem and the human subsystem within" (Hodge, 1997, p.9) or "a dynamic equilibrium in the process of interaction between a population and the carrying capacity of its environment such that the population develops to express its full potential without producing irreversible adverse effects on the carrying capacity of the environment upon which it depends" (Ben-Eli, 2018, p.1340).

As sustainability covers all aspects of human life (e.g., planet, people) it is increasingly applied in any domains, such as agriculture and trade. Last decades witnessed the emergence of a plethora of studies related to the close relationship between global trade and sustainability (Røpke, 1994; Gammage *et al*, 2019; Bertram, 2023; Gilson, 2023; Methmini *et al*, 2024). Global trade cannot "realize its full potential without commitment to environmental stewardship and social development" (Hinrich Foundation, 2024a, p.1). Implementing the sustainability concept in the global trade imposes companies which trade all over the world sound strategies (Toma *et al*, 2013; Toma *et al*, 2015; Toma *et al*, 2016a) based on strategic thinking and planning (Toma *et al*, 2016b; Toma *et al*, 2016c), and competitive and sustainable business models (Tohănean *et al*, 2018; Toma *et al*, 2018; Toma *et al*, 2019) based on lean (Naruo *et al*, 2007; Marinescu *et al*, 2008) and agile management (Toma, 2023), quality management (Toma, 2006; Toma *et al*, 2009), social responsibility (Toma *et al*, 2011; Imbrișcă *et al*, 2020) and corporate citizenship (Toma, 2008a; Marinescu *et al*, 2010), Six Sigma (Toma, 2008b), balanced scorecard (Toma *et al*, 2010) and marketing mix (Catană *et al*, 2021).

At a global level, sustainable trade appears when "the international exchange of goods and services yields positive social, economic and environmental benefits, reflecting the four core criteria of sustainable development:

1. It generates economic value.
2. It reduces poverty and inequality.
3. It regenerates the environmental resource base.
4. It is carried out within an open and accountable system of governance." (Vorley et al, 2002, p.5). In other words, sustainable trade represents „the import, export, or trade of goods and services which actively support the achievement of one or more UN Sustainable Development Goals

(SDGs) without infringing on the achievement of any other SDGs" (International Chamber of Commerce, 2021, p.6). In order to measure this concept, the Hinrich Foundation created the STI in 2016. The index encompasses 72 indicators which are classified into three main pillars, as follows:

- economic (Table no. 1),
- societal (Table no. 2),
- environmental (Table no. 3).

Table no. 1. Economic pillar indicator list

No.	Indicator
1	Consumer price inflation
2	Real gross domestic product (GDP) Growth per capita, % GDP
3	Growth in labor force, %
4	Foreign direct investment, net inflows, % GDP
5	Gross fixed capital formation, % GDP
6	Tariff & non-tariff barriers
7	Trade liberalization
8	Exchange rate stability, parity change from national currency to special drawing rights, 2023/2021
9	Domestic credit to private sector, % of GDP
10	Foreign trade and payments risk
11	Trade costs
12	Monetary policy intervention
13	Export concentration
14	Exports of goods and services
15	Technological innovation
16	Technological infrastructure

Source: (Hinrich Foundation-IMD, 2024b)

Table no. 2. Societal pillar indicator list

No.	Indicator
1	Inequality (Gini coefficient)
2	Educational attainment
3	Labor standards
4	Political stability and absence of violence
5	Goods produced by forced labor or child labor
6	Government response to human trafficking
7	Trade in goods at risk of modern slavery
8	Social mobility, index
9	Life expectancy at birth
10	Uneven economic development
11	Universal Health Coverage Index

Source: (Hinrich Foundation-IMD, 2024b)

Table no. 3. Environmental pillar indicator list

No.	Indicator
1	Air pollution, PM2.5 micrograms per cubic meter
2	Deforestation, index
3	% of wastewater treated
4	Energy intensity, energy consumed for each US\$1,000 of GDP in tone of oil equivalent
5	Ecological footprint
6	Renewable energy, %
7	Environmental standards in trade, count
8	Transfer emissions, million tones carbon
9	Share of natural resources in trade, %
10	Carbon

Source: (Hinrich Foundation-IMD, 2024b)

In sum, the relationship between global trade and sustainability represents a topic of interest for both practitioners and researchers, especially due to the fact that achieving UN SDGs have become a major concern for countries, governments, and companies worldwide. Taking into account this important issue, the paper analyses the evolution of the STI in the period 2020-2024 in its fourth part.

3. Research methodology

In order to accomplish the objectives of the paper, the author employed a qualitative scientific research method. In the beginning, he gathered the information from different secondary data sources, such as articles, books, and reports. Then, the author carried on the literature review and analyzed the information. At the end of the research process, he synthesized the information and designed the paper.

4. Findings

The sustainability of trade is measured by the STI which allows the benchmarking of the following 30 economies around the world within the global trade system: New Zealand, United Kingdom, Australia, Singapore, Japan, South Korea, Hong Kong SAR, Canada, Taiwan, United States, Chile, Thailand, Philippines, Vietnam, Malaysia, China, Mexico, Indonesia, Cambodia, Peru, Ecuador, Laos, India, Brunei, Bangladesh, Sri Lanka, Myanmar, Pakistan, Papua New Guinea, Russia. In 2022, the hierarchy was dominated by New Zealand (score 100), a country which vigorously performed in all three dimensions (Table no. 1): first in both societal and environmental pillars, and seventh in the economic pillar (Hinrich Foundation-IMD, 2022). It was followed by United Kingdom (score 94.4) and Hong Kong SAR (score 87.9).

Table no. 1. Top 10 economies in the STI 2022

Country	Overall	Economic pillar	Societal pillar	Environmental pillar
New Zealand	1	7	1	1
United Kingdom	2	5	4	2
Hong Kong SAR	3	1	10	8
Japan	4	9	5	4
Singapore	5	2	9	10
Australia	6	11	3	14
Canada	7	10	2	23
South Korea	8	3	8	16
United States	9	4	7	19
Taiwan	10	6	6	27

Source: (Hinrich Foundation-IMD, 2022)

In 2023, New Zealand (score 100) remained at the top of the ranking, a country which robustly performed in all three dimensions (Table no. 2): first in the environmental pillar, second in the societal pillar, and eighth in the economic pillar (Hinrich Foundation-IMD, 2023). It was followed by United Kingdom (score 96.5) and Singapore (score 94.1).

Table no. 2. Top 10 economies in the STI 2023

Country	Overall	Economic pillar	Societal pillar	Environmental pillar
New Zealand	1	8	2	1
United Kingdom	2	5	4	2
Singapore	3	1	8	5
Hong Kong SAR	4	3	10	7
Australia	5	12	3	10
South Korea	6	2	7	17
Canada	7	9	1	19
Japan	8	10	5	12
United States	9	4	9	15
Taiwan	10	6	6	27

Source: (Hinrich Foundation-IMD, 2023)

In 2023, New Zealand (score 100) kept the first place at the top, a country which performed very well in all three dimensions (Table no. 3): first in both societal and environmental pillars, and seventh in the economic pillar (Hinrich Foundation-IMD, 2024). It was followed by United Kingdom (score 97.7) and Australia (score 87.4).

Table no. 3. Top 10 economies in the STI 2024

Country	Overall	Economic pillar	Societal pillar	Environmental pillar
New Zealand	1	7	1	1
United Kingdom	2	6	4	2
Australia	3	10	3	6
Singapore	4	2	6	10
Japan	5	11	8	4
South Korea	6	3	7	15
Hong Kong SAR	7	1	10	7
Canada	8	8	2	18
Taiwan	9	9	5	17
United States	10	4	9	16

Source: (Hinrich Foundation-IMD, 2024b)

Therefore, the analysis of the evolution of the STI in the period 2022-2024 reveals the absolute domination of New Zealand, followed by United Kingdom. In spite of a lower performance in the economic pillar, New Zealand robustly performed in both societal and environmental pillars.

5. Conclusions

Since the beginnings of the 21st century, sustainability has become a growing concern not only for countries and governments but also for various organizations all over the world. This is why all economic activities, including global trade, have to take into account this important issue.

The study enlarges the scientific literature related to the global trade-sustainability complex relationship. It illustrates the concept of sustainable trade and analyses the evolution of the STI in the period 2022-2024, an index that measures the sustainability of trade by taking into account the UN SDGs. Further studies may expand this research by revealing other features of sustainability and global trade.

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Digital Remedy: A Prophylaxis for Business Failure in Emerging Markets

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Abstract

The introductory phase is a critical stage in the growth and development of any small business. Past studies have reported a high mortality rate of SMEs within the first few years of commencing business operations. With the advent of technology in the rapidly advancing business scenario, digital tools and strategies are increasingly identified as essential for business survival and growth. Methodologically, the study adopted secondary data to proffer an all-inclusive and comprehensive technique to comprehend how digital remedies can be prophylaxis (preventive measure) against business mortality using secondary data from academic journals, industry reports and peer-reviewed articles on digital transformation and highlighted causes of business failures. This study forms a bedrock for a more in-depth analysis of digital resolutions, such as data analysis, artificial intelligence AI, automation, cloud computing, digital marketing, and advertisement, as prophylaxis or preventive measures for common causes of business failure. The findings of a more comprehensive study will provide insight for stakeholders desiring to alleviate risks, enhance operations, and remain competitive in an ever-evolving digital economy.

Key words: digital remedies, Artificial Intelligence, business failure, small and medium enterprises performance, mortality rate

J.E.L. classification: L29, O33

1. Introduction

Over the years, SMEs have contributed to economic growth. Businesses are created to bridge the gap and meet the needs and wants of the populace by creating value and wealth and transforming raw materials into finished products and services. The major challenge most SMEs face is the survival of the teething period. The first five years of upcoming business portend to be the toughest. Most of the challenges range from financial issues to finding suitable suppliers of raw materials at the right place and the right quality to brand loyalty, among others. One of the values that will make an entrepreneur stand out is having the proper orientation. These include proactiveness, risk-taking, and innovation (Chima et al., 2023, p.84).

Data from the U.S. Bureau of Labour Statistics revealed that 20% of newly established businesses fail within the first two years, 45% do so within the first five, and 65% do so within the first ten. Ahamed and Mallick (2019, P.403) studied 2635 banks in 86 countries over eight years and found that higher financial inclusion contributes to greater bank stability. The survey reported that only 25% of newly established enterprises survive for 15 years or more. The U.S. Bank study reported that 82% of business failures were credited to cash flow stressing the significance of appropriate and effective cash management in businesses' continuous existence, survival, and success. A similar survey by QuickBooks discovered that 61% of small enterprises commonly need help with cash flow, with slightly above 50% of all bills being paid promptly (U.S. Bank, 2023).

According to Muriithi (2017, pp.36-37), enterprises make up at least 90% of businesses in developed and developing nations because they are the main drivers of employment, taxation, job creation, and GDP (Gross Domestic Product) contributions. Around 90% of companies in South Africa are classified

as micro, small, and medium-sized businesses, which generate more than 80% of the country's employment and more than 50% of its GDP (Petersen et al., 2020, p.111). Mhlongo & Daya's survey from 2023 highlighted that the majority of micro, small, and medium-sized businesses face higher rates of failure and poorer performance because of poor entrepreneurial leadership abilities, insufficient funding or cash flows, inadequate training and education programs, inadequate technology infrastructure, crime, and corruption.

Most of the literature cited in this study demonstrates that SMEs are a formidable force needed to stabilise the value chain and support medium-scale and large corporations in economic stability and sustenance. This study aims to determine why small and medium-sized businesses (SMEs) fail within their first two years of business. Predominant elements associated with SMEs' performance are those associated with the owners' motivations, personality, personal values, and managerial skills

Having established that SMEs contribute to economic development and most fail during the business's infancy period, it is pertinent to proffer a solution to elongate the business lifespan. One would have expected that due to technological transformation and information available on the internet, businesses will have all it takes to succeed in the first decade of its existence. Therefore, the study forms a basis for a more detailed study on business, industry trends, why businesses fail during their tooting period, and the role of digital transformation in cubbing business failure, mitigating risks, optimising operations, and maintaining a competitive edge in the ever-evolving digital economy.

2. Theoretical background

In any given economy, it has been shown that the number of SMEs outnumbers and employs more people than large enterprises (Olorunshola & Odeyemi, 2022). Across the globe, about 90% of all companies are SMEs and account for above 50% of all employment (Gómez & Titi, 2023). About 99% of the EU businesses are SMEs (Gómez & Titi, 2023), which is slightly above that of Australia, with SMEs accounting for about 98%; a report in 2014 reveals that 98.5% of firms in Chile were classified as SMEs (Chile, 2016). Small businesses comprise more than 99% of all firms in the U.S., contribute at least 43.5% of the entire U.S. GDP, and are estimated to pay 39.4% of all U.S. private payroll and 62.7% of new U.S. jobs from 1995 to 2021. The literature considers many factors when defining the term "small business." These factors include the size of the company, management duties or responsibilities, turnover, gross income, taxable income, net assets, ownership concentration, equity, number of employees, stage of the business life cycle, and industry-based size relativity.

Definitions of SMEs also vary from region to region. The definition of the region is quite elusive, as it may vary from district to area-territory-zone-country-continent or realm. In this research, a *region* is defined as a single country with a strong economy or a group of countries forming an economic block. An economic block would be, for example, the European Union (EU) or the Southern African Development Community (SADC); however, the United States of America, for example, could also be regarded as either a country or economic bloc because of its strong economy, technological advancement and worldwide use of its currency, when compared to all the other countries on the American continent. Similarly, South Africa can be regarded as a country or economic bloc because of its strong economy and currency compared to the SADC region and the rest of Africa. On the other hand, Australia qualifies as both a country and a continent and may be regarded as an economic entity.

SMEs adhere to an organisational cycle which is a process of categorising the problems and growth patterns of small businesses in a systematic way that is useful to entrepreneurs. Like all other businesses, SMEs pass through stages from conception, initiation, maturity, and decline, referred to as the traditional organisational lifecycle. Each phase is exposed to distinctive challenges and opportunities. Being aware of the intricacies of each stage will help the organisation to anticipate and identify possible risks, make informed decisions, and leverage the opportunities for business success and sustainability (Schmidt, 2024). The scale and potential for expansion of small enterprises vary greatly. Their distinct management styles, varying organisational structures, and independence of action are what define them. However, a closer examination reveals that they have similar issues that arise at roughly the exact times in their growth.

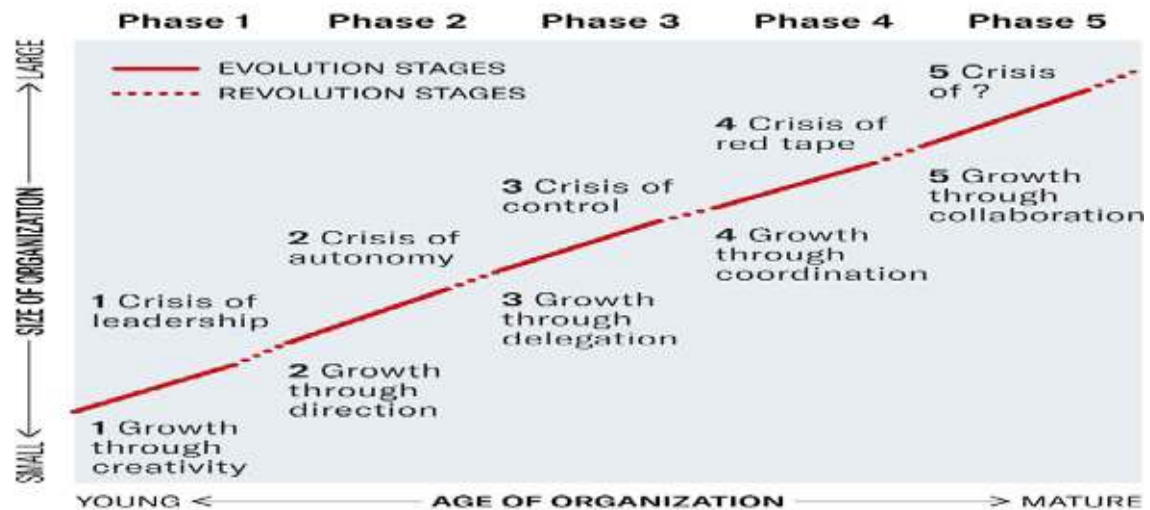
Churchill and Lewis (1983) developed a model appropriate for small and growing businesses that outlines five phases or stages of firm development. These stages are:

- i. **Existence**-concerned with gathering customers and delivering the product or service contracted for.

- ii. **Survival**--generating enough cash flow to break even and replacement of capital assets as they wear out.
- iii. **Success**--here the decision facing owners is whether to exploit the company's accomplishments and expand or keep the company stable and profitable, providing a base for alternative owner activities
- iv. **Take-Off**-- how to make the firm grow rapidly and finance this growth; and
- v. **Resource Maturity**--companies have the advantages of size, financial resources, and managerial talent and will be a formidable force in the market if they retain their entrepreneurial spirit.

According to Churchill and Lewis (1983), each stage is characterised by an index of size, diversity, and complexity and is described by five management factors: managerial style, organisational structure, extent of formal systems, major strategic goals, and the owner's involvement in the business.

Figure no. 1 Growth of SMEs by age of the organisation



Source: Authors' contribution after (Churchill, N. & Lewis, V.L., 1983)

Table no. 1 SMEs definitions in different countries by number of employees and annual turnover

Country	Maximum number of employees	Annual Turnover	Source
Australia	200 0 < Micro < 4 5 < Small < 20 21 < Median < 200	N/A N/A N/A	(Alkhoraif et al. 2018) (SMEAA, 2011) (SMEAA, 2011) (SMEAA, 2011)
Canada	Small < 99 100 < Median < 499	< \$ 1million \$1 Million < \$ 5 Million	(Gibson et al 2011, Seens, 2015) (Gibson et al 2011, Seens, 2015)
China	999		
EU & UK	250 Micro < 10 Small < 50 Medium < 250	≤ € 2 Million ≤ € 10 Million ≤ € 50 Million	(Alkhoraif et al. 2018)
USA	499 Small < 99 100 < Median < 499		(Alkhoraif et al. 2018) (USCE, 2016) (USCE, 2016)

Source: Authors' contribution

3. Research methodology

3.1. Statement of the problem

Numerous opportunities and challenges plague businesses operating emerging markets. Due to the large and rapid growing population of most of these emerging economies, they are characterized by rapid economic growth, changing consumer needs and behaviour, and the prospects for untapped market share.

Most of the emerging market are challenged by potential risks, ambiguities, and uncertainties arising from economic volatility, political instability, inadequate infrastructure, regulatory uncertainty, and limited access to capital. In the face of these challenges, many businesses especially the small and medium-sized enterprises (SMEs) might lack adequate resources, capabilities, skills, and resilience to handle such challenges.

One of the major factors that may pose a challenge to SMEs in a developing world is their ability to adapt to a rapidly changing environment. In the past two decades, the emergence of digital transformation portends to be a veritable tool that can help businesses mitigate risks, increase operational efficiency, enhance customer engagement, and expand market reach. However, despite the growing recognition of the importance of digital strategies, many businesses in emerging markets are either slow to adopt or unable to fully leverage digital technologies due to barriers such as digital illiteracy, infrastructure limitations, high costs, and a lack of skilled talent.

Therefore, the fundamental problem identified by the researchers is how to address the gap between the potential benefits of digital strategies and the actual implementation and impact of digital tools in preventing business failure in emerging markets. While there is a growing body of research on digital transformation in developed economies, there is limited understanding of how digital remedies can serve as a prophylaxis for business failure in the unique context of emerging markets.

Our **key research problem** is: How can digital tools and strategies help businesses in emerging markets avoid failure and build resilience in the face of the challenges they face? Thus, the study seeks to explore the specific digital remedies—ranging from e-commerce platforms, cloud computing, and artificial intelligence (AI) to digital payments and marketing solutions—that businesses in emerging markets can adopt and to what extent these strategies contribute to the survival and growth of businesses in environments characterized by high levels of risk and uncertainty. By addressing this gap, the research aims to provide valuable insights that can guide policymakers, business owners, and stakeholders in crafting strategies for sustainable growth and long-term success in emerging markets.

In this context, this study reviews relevant literature on how digital remedies can reduce the mortality rate of small—and medium-scale enterprises in emerging economies. The methodology highlights some of the techniques that can be used to investigate the role of digital remedies, such as E-commerce and digital payments, cloud computing and big data analysis, digital market and customer engagement, and mobile technologies and service accessibility. Secondary data from scholarly articles, journals, and online documentation was used to identify some of the causes of SME failure in the first few years of its existence and how organisations have used digital tools, as listed above, to prevent business failure. Content Analysis from the existing related literature was deployed to identify predominant digital tools that contributed to the sustainability of businesses that might have otherwise gone into extinction.

Our **research objectives** are:

- To identify the major causes of business failures in emerging markets.
- To assess digital strategies and technologies that businesses in emerging markets are required to mitigate risks of failure.
- To examine to what extent digital remedies can help businesses overcome challenges exclusive to emerging markets.
- To evaluate the measurable impacts of digital transformation on business sustainability in emerging markets

3.2. Research design

A mixed-methods research design integrating both qualitative and quantitative approaches will be employed in this study. The research design will employ provide a comprehensive perspective of how digital tools and strategies can assist businesses in emerging markets evade failure especially in the first five years of its existence. Also, the mixed- methods design will make room for the triangulation of data from various sources to ensure validity and reliability.

The **population** will include SMEs in Major cities in Nigeria and South Africa from where the samples will be drawn from.

Data collection methods for qualitative data will be interviews and case studies. The interview includes in-depth with business leaders, technology experts especially those involved in digital transformation, at least 15 key respondents from various sectors of SMEs for a focused group discussion and interview. The major focus for the discussion will be how digital tools such as Artificial Intelligence,

cloud computing, e-commerce platforms, digital payments can be integrated into business models to pervert possible risk. The case studies will be conducted from selected SMEs in Nigeria Major cities (Abuja, Lagos, and Nnewi) and in South Africa major cities (Johannesburg, Cape town, and Durban).

For quantitative data, a Google form questionnaire will be distributed to the selected SMEs. The questions will include respondents' knowledge of digital tools available for SMEs, the challenges faced by these businesses, and their perceptions of how digital strategies have influenced business outcomes (growth, survival, profitability), Business performance indicators before and after digital adoption, Perceived challenges of digital transformation, Impact on competitive advantage, customer engagement, and operational efficiency.

Statistical Analysis. The data will be keyed into Microsoft EXCEL and analysed using SMART PLS 4 and SPSS 26. Regression and correlation analysis will be used for quantitative data while Thematic content analysis, and SWOT analysis will be used for the qualitative data.

Ethical consideration. The researchers will get adequate consent from all the interviewees and survey participants about the purpose of the research and how their data will be utilised before being included into the survey. Also, participants will be assured of the confidentiality of the data provided by not including personal data like name of the participant or their personal identity number. The survey will ensure the accuracy and reliability of all data collected, predominantly through transparent and objective survey and interview processes.

4. Findings

4.1. Reasons for small businesses' failure

Business failure is not peculiar to a particular sector of the economy or the size of a nation. However, it varies across sections, regions, industries, businesses, and the duration of the business. Due to various environmental challenges and unforeseen circumstances, initiating and sustaining a business can be challenging. The failure rate varies from one economy to another. In the USA, the data released by the Bureau of Labor Statistics (BLS) 2022 reports that approximately 20% of new businesses collapse within the first two years, about 45% crash within five years, an estimated 65% of businesses fail within 10 years of existence; while about 70-80% of small businesses ultimately fail in the first 10 years (source: BLS, 2022). Small businesses are easier to set up and improve the standard of living of local communities. Therefore, understanding why small businesses succeed or fail is essential to the sustainability of the economy. The results of this research will help identify the root cause of the issue and provide solutions. It is now commonly acknowledged that a country's economic progress is significantly influenced by the proliferation of small companies (UNDP, 2000).

El-Sharawy and Abouzeid's (2015) empirical study looked at the Egyptian business environment while examining the barriers to success facing startups and small firms. They claim that small businesses are vital to the economy and that when they fail, the effects on the economy can be catastrophic. The research's hypothesis—that management insufficiency is the most frequent reason for small business failure in the Egyptian market—was validated based on the data analysis. In addition, poor decision-making, inadequate capitalisation, and incompetent management all contribute to business failure.

In their 2019 study, "Business Failures Around the World: Emerging Trends and New Research Agenda," Amankwah-Amoah and Wang (2019, p.367-369) examined how many organisations will inevitably experience business failures. In order to avoid significant challenges, they collected and applied lessons learned from mistakes and reduced needless company failures. In addition, their study looked at how young entrepreneurs overcome their fear of failing their enterprises and how more research is needed to determine why and how many small businesses fail as they grow from startups to huge enterprises that might eventually fail. Similarly, Zhang et al. (2019, p.427-429) developed a novel model of how exogenous and endogenous factors combine to produce stages/processes of business failures by drawing on the experiences of fifty failed Chinese entrepreneurs.

Using a matched sample of 808 failed and non-failed firms, Muñoz-Izquierdo, Segovia-Vargas, Camacho-Miñano, and Pascual-E (2019; p.403) explored the causes of business failure using audit report disclosures. Their findings suggest that audit report disclosures play a significant role in explaining the causes of business failure. In 2020, Twesige, Gasheja, Hategekimana, Nkubito, and Hitayezu analysed Rwandan business failure factors and proposed a recommended course of action for business sustainability in the country. The researchers combined positivism and phenomenology with a multi-

method approach to create a combination approach. Data was gathered through documents and questionnaires from various corporate organisations. The researchers concluded that both qualitative and quantitative aspects influence a business's success or failure.

Elbahjaoui, Elabjani, and Ciloci (2022) investigated the reasons why Morocco's tiny or micro businesses failed. To comprehend the intricacy of the internal processes involved in small business operations, they concluded, based on their research, that both endogenous and external variables contribute to the failure of small enterprises. In Burao, Somaliland, Mohamed (2022) researched to determine the internal and external factors that influence small business failure. The study was survey research, meaning that 200 respondents who owned small firms had yet to provide information via questionnaires. With the use of SPSS 21, the data was examined using descriptive statistical techniques. The study discovered that the following were the most significant internal causes: a lack of advice from seasoned and qualified businesspeople; a poor advertising or promotional plan; a wrong choice for the location of the business site; a lack of awareness of the current state of the industry; the absence of a transparent target market; unfavourable economic conditions; and high operating costs, such as rent and salaries. Entrepreneurship contributes to economic growth in South Africa and worldwide by raising living standards, increasing productivity, and creating jobs. According to UNDP (2000), small firms contribute to employment creation, product and service innovation, and providing specialised expertise to large corporations.

Lack of industry experience. Every firm functions in a particular environment, and a lack of experience in that industry or area results in a poorly organised business and underutilised resources.

Inadequate financing. A developing company needs financing to stay afloat to avoid business failure.

Inadequate cash flow gauges a company's ability to maintain enough cash flow to pay its short—and long-term financial obligations. Many small businesses fail because their owners do not budget for how much money will arrive each month and how much can be spent.

Poor business planning. Almost nine out of ten business failures in developing nations like South Africa result from inadequate planning and general business management abilities. A strong business plan aids in identifying the mission, vision, cost structure, market, external influences, strengths, weaknesses, opportunities, and threats. The South African perspective is worsened by the environment that small businesses face when planning comprehensive business. Sometimes, they must pay exorbitant amounts to avoid being rejected by financial institutions.

Management incompetencies. Management incompetencies have been attributed to being one of the contributing factors to business failures. Inadequate management can be attributed to either incompetence or inexperience. Effective management effectively implements and oversees a company's strategic and operational strategy.

Political instability. Political instability is a change in some countries in Africa, and it has a way of affecting businesses in a way that they cannot be as productive as they would have been in a stable Shoprite, a South African retailer, closed its businesses in Nigeria, Uganda and Madagascar due to an unstable political environment that has led to currency depreciation, high commodity prices, and high inflation which in turn affected local household incomes thus company revenues.

Diminished customer base. Competition may result in a decline in the consumer base. Small businesses should concentrate on a customer approach that generates revenue. Concentrating solely on one secret to success is risky, however. Increasing the variety of clientele is crucial to growing the company. Maintaining a firm requires the ability to adjust to changing ideas and trends.

Poor system of control. In addition to establishing appropriate targets for business management, a control system is required to gauge performance. Checks and measurements aid owners in managing organisational operations. A company can modify its internal organisational operations but cannot control the external elements, like competitors and customers that affect its surroundings.

Failure to innovate. Many businesses fail because they are unable to capitalise on rapidly changing technology or customer demands.

Unfavourable government policy. Unfavourable government policies can affect businesses. For instance, media reports asserted that major Multinational companies are relocating their offices from Nigeria between 2020 and the date due to economic challenges and the fluctuations of the naira. Africell, a major telecom company operating in Uganda, left the market in 2021, citing high transaction costs after the Ugandan government hiked taxes on local internet data, Africell's main core market.

Poor marketing. Another major reason for business failure in Africa has been associated with poor marketing. There is an advert that says if you do not say it, you will not sell it. It is said that 1 in 2 businesses launched in Africa end up failing due to poor marketing (Researchtec). Other reasons include poor market research, a wrong target market, and poor product-market fit.

Lack of entrepreneurial skills. A firm might collapse due to an owner's lack of entrepreneurial abilities, competencies, and capabilities, usually during the enterprise's startup phase as a company matures and grows later in life when more managerial and administrative abilities are needed. The performance of a small corporation rests on several factors, such as the traits and actions of individual owners and external factors. Entrepreneurs typically take significant risks and have a strong drive for success and social consciousness. As a result, an owner's personality and personal traits may contribute to the failure of a business.

Kunle (2022, p.38), in "What are the causes of small business failure in Burao, Somaliland?" highlighted eight predominant causes of small business failure in Burao. Five of these were external causes, and three were internal causes. These were poor economic conditions, lack of consultation with experienced and professional business people, and ineffective advertising or promotional strategy. Poor business site location; high operating expenses; lack of knowledge of current business situation; competition; and lack of specific target market. The above list of reasons is inexhaustive, as many more failure scenarios can be investigated. If these were the only ones, there would be no need to conduct further research on this topic. The researchers focused on identifying contributing factors to SMEs' high failure rate within the first two years of commencing business operations, rejuvenating the title and making it worthwhile.

4.2. Digital remedies for business failure

The last two decades have witnessed a rapid increase in digital technologies that have predominantly transformed how businesses operate globally. These digital tools have been deployed by developed and industrialised nations. If emerging economies are to catch up with the developed world, mitigate risks of business failure, and improve efficiency, they must adopt digital tools and strategies. These tools and strategies have become crucial for business survival and growth, providing solutions to challenges such as economic instability, poor infrastructure, and limited access to resources.

This literature review explores the key digital remedies businesses in emerging markets adopt and their effectiveness in mitigating the risks associated with operating in such environments.

4.2.1. Digital transformation in emerging markets

Emerging markets are often defined by volatility, where businesses are exposed to unique risks such as currency fluctuations, political instability, regulatory uncertainty, and inadequate infrastructure. In such contexts, digital technologies have emerged as powerful tools for overcoming these challenges. According to World Bank (2016), digital technologies can help firms reduce operational costs, improve service delivery, and expand market reach, particularly in regions with underdeveloped physical infrastructure. Digital tools allow businesses to leapfrog traditional barriers and create more resilient business models by facilitating better decision-making, enhancing customer engagement, and improving supply chain management.

McKinsey & Company (2018) highlights that digital transformation in emerging markets has been associated with improvements in productivity, revenue growth, and customer satisfaction. In particular, SMEs in these markets are increasingly adopting cloud computing, e-commerce platforms, mobile banking, and digital marketing solutions as key components of their strategy to enhance competitiveness. The ability to scale operations with fewer capital investments and reach customers across borders has made digital transformation indispensable for businesses looking to survive in an unpredictable economic environment.

4.2.2. Digital remedies

1. E-commerce and Digital Payments. One of the most significant digital remedies for businesses in emerging markets has been the adoption of e-commerce platforms and digital payment systems. These tools help businesses reach a larger, more diverse customer base, bypassing geographical and logistical barriers. The widespread use of smartphones in emerging markets has accelerated the growth of mobile commerce and digital payments. Fonseka et al. 2022, ii the impact of E-commerce Adoption on the

Business Performance of SMEs in Sri Lanka, the Moderating Role of Artificial Intelligence, reported that E-commerce Adoption positively and significantly influences business performance and AI moderates the relationship between e-commerce adoption. Moreover, digital payment systems provide businesses with an efficient way to handle transactions, mitigate risks associated with cash handling, and improve financial transparency. For example, in regions like Sub-Saharan Africa, where traditional banking infrastructure is lacking, mobile payment systems like M-Pesa have enabled businesses to thrive by offering secure, accessible, and low-cost payment options (Jack & Suri, 2011).

2. Cloud Computing and Big Data Analytics. Cloud computing has become another critical tool in the digital arsenal for businesses in emerging markets. By adopting cloud-based solutions, businesses can scale their operations more effectively without the need for heavy investment in on-site IT infrastructure. Cloud computing facilitates collaboration, data storage, and access to advanced technologies such as artificial intelligence (AI) and Machine Learning (ML), which can be used for predictive analytics and decision-making. As Brynjolfsson and McAfee (2014) highlighted, leveraging big data allows businesses to gain valuable insights into customer behaviour, market trends, and operational inefficiencies. In emerging markets, where access to real-time data is often limited, cloud-based analytics can help businesses make more informed decisions, respond to market shifts, and optimise supply chains, reducing the risk of operational failure.

3. Digital Marketing and Customer Engagement. Digital marketing and social media platforms have revolutionised how businesses connect with customers in emerging markets. According to (Kaur, 2023, p.33), social media and targeted digital advertising enable businesses to engage directly with consumers, build brand loyalty, and personalise marketing campaigns. These tools are especially valuable for small businesses in emerging markets, which often struggle with limited marketing budgets and resources. Digital marketing offers a cost-effective means of reaching a wider audience and competing with larger, more established players. Furthermore, digital platforms like Facebook, Instagram, and WhatsApp have become essential for businesses looking to expand their market reach and improve customer interaction. By engaging with customers in real-time and leveraging data from digital interactions, businesses can foster stronger relationships and respond more quickly to consumer needs.

4. Mobile Technologies and Service Accessibility. Mobile technologies have also played a crucial role in facilitating business growth and survival in emerging markets. As of 2023, mobile penetration in emerging markets is on the rise, particularly in regions like Asia and Africa, where mobile phones are often the primary means of accessing the internet. Rohit and Sharma (2019) suggest that mobile apps, SMS-based services, and mobile-enabled solutions have been transformative for businesses in sectors like healthcare, agriculture, and financial services. For example, mobile-based agricultural platforms such as AgriDigital and TaroWorks provide farmers with real-time market prices, weather forecasts, and access to financial services, improving decision-making and profitability. Similarly, mobile health services are providing healthcare access to underserved populations in rural areas, enabling businesses in the healthcare sector to reach new customers and operate efficiently despite infrastructural challenges.

Table no. 1 Summary of digital remedies using Content Analysis

Digital Approach	Remedy
<i>E-commerce and Digital Payments</i>	SMEs can use Point On Sale- POS transactions and mobile banking to make transactions. SMEs can access goods and services without fear of barriers. digital payment systems provide businesses with an efficient way to handle transactions, mitigate risks associated with cash handling, and improve financial transparency. SMEs can reach a wider audience.
<i>Cloud computing</i>	By adopting cloud-based solutions, businesses can scale their operations more effectively without the need for heavy investment in on-site IT infrastructure. Cloud computing facilitates collaboration, data storage, and access to advanced technologies such as artificial intelligence (AI) and Machine Learning (ML), which can be used for predictive analytics and decision-making.
<i>Digital marketing and customer engagement</i>	Digital marketing offers a cost-effective means of reaching a wider audience and competing with larger, more established players. Digital platforms like Facebook, Instagram, and WhatsApp have become essential for businesses looking to expand their market reach and improve customer interaction. By engaging with customers in real time and leveraging data from digital interactions, businesses can foster stronger relationships and respond more quickly to consumer needs.

<i>Mobile technologies and service accessibility</i>	Mobile apps, SMS-based services, and mobile-enabled solutions have been transformative for businesses in sectors like healthcare, agriculture, and financial services.
<i>Blended/online learning</i>	Blended learning, which is a combination of traditional face-to-face learning and online learning, can be a prevailing tool for developing entrepreneurial competencies. Business owners can learn more about their businesses and increase in skills.
<i>Business tracking software</i>	Availability of information in the face of political and economic instability. There are numerous digital platforms and software that can be used to track businesses.

Source: Authors contribution

4.2.3. Challenges to digital transformation in emerging markets

Despite the potential benefits of digital transformation, businesses in emerging markets face significant barriers to adopting digital tools. Key challenges include:

- **Digital Literacy and Skills Gap:** Many businesses in developing markets struggle to find employees with the necessary digital skills to implement and manage new technologies. A report by the OECD (2019) emphasised the importance of digital literacy for businesses to leverage the potential of digital tools fully.
- **Infrastructure Limitations:** In regions with limited or unreliable internet access, businesses may struggle to adopt cloud-based solutions or implement e-commerce platforms fully. Gopalakrishnan et al. (2020) note that poor infrastructure, such as inconsistent electricity supply and limited broadband coverage, continues to hinder the widespread adoption of digital solutions.
- **Cultural and Regulatory Barriers:** In some regions, businesses may face resistance to digital tools due to cultural preferences or regulatory hurdles. Fitzgerald et al. (2014) argue that businesses must navigate complex regulatory environments when implementing digital strategies, which can delay or obstruct their digital transformation efforts.

5. Conclusions

One of the ways to reduce poverty and unemployment in emerging economies is through job creation, wealth creation, and entrepreneurship. Education, collaboration, and digital remedies have proven to be effective in helping businesses in emerging markets navigate the complex risks they face. E-commerce platforms, digital payments, cloud computing, and mobile technologies are key tools that have enabled businesses to scale operations, engage customers, and improve operational efficiency. However, significant barriers such as digital illiteracy, infrastructure gaps, and regulatory challenges remain. For businesses to fully realise the benefits of digital transformation, targeted investments in digital skills development, infrastructure improvement, and regulatory reform are essential.

In addition, social security, education, and the government's ability are crucial supplements. The strategy depends on a few positive economic variables outside the nation's control, like global commodity prices and improved trade ties throughout Africa. All economic sectors stand to gain significantly from high output and employment growth if this scenario comes to pass. The private sector will generate most of the new jobs, strengthening tax receipts, supporting the fiscus, and establishing a positive feedback loop of investment, growth, and development. The private sector will generate most of the new jobs, strengthening the fiscus, increasing tax revenues, and starting a positive feedback loop of investment, growth, and development.

The study recommends a comprehensive study of the impact of digital remedies to curb business failures of upcoming businesses in major cities of Africa to establish the assertion that digital remedies can actually help the growth of SMEs in developing countries. The authors suggest sponsored research in the future that could investigate the integration of primary data using mixed methodology, such as surveys or interviews with business owners across various sectors of the economy in major cities of developing economies in the African region to authenticate further and validate the secondary data findings.

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The Financial Implications of Integrating Geomorphic Tactile Display Technology into Smart Devices: An Economic Perspective

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Abstract

Integrating geomorphic tactile display technology into smartphones represents a transformative leap in assistive technology and consumer devices. This paper examines the economic ramifications of incorporating this technology into smartphones, of introducing geomorphic tactile display devices as alternatives to conventional Braille devices and smartphones. These innovative solutions, leveraging ferrofluid and geomorphic principles, promise cost efficiency, scalability, and inclusivity using the 'iPhone 15 Pro' and 'Samsung Galaxy Z Flip' as benchmarks. By comparing costs, market viability, and potential savings, we assess how geomorphic tactile displays could redefine device affordability, accessibility, and functionality for both general consumers and visually impaired users.

Key words: accessibility, Braille, 3D Imaging, geomorphic display, ferrofluid

J.E.L. classification: I20, O36, C6

1. Introduction

What are ferromagnetic fluids and magnetic fluids? If you're familiar with magnetic fields then you will know how iron filings or other micro conductive elements such as copper react to the presence of magnetic fields, by forming electromagnetic field lines indicating the poles of the magnet namely north and south poles. Thus, ferromagnetic fluid is a hybridized liquid polymer consisting of iron filings in a liquid solution.

Can you imagine how ferromagnetic fluids in electronic devices like smartphones, laptops or smart Tv's? How they would drastically change the nature of user interaction. The felicity of being able to share digitalized books photos or perhaps even videos through the added sense of touch. Imagine a device where one can download millions of books in Braille in the palm of the hand!

Smartphones have become indispensable tools for communication, education, and accessibility. However, their utility for visually impaired users remains limited without additional costly assistive devices. The integration of geomorphic tactile display technology—a system capable of rendering dynamic 3D tactile surfaces—into smartphones could revolutionize how users interact with devices. This study explores the financial implications of such integration, focusing on cost benchmarks, potential savings, and economic accessibility.

Bridging Economic Barriers in Assistive Technology Access to assistive devices for the visually impaired, such as Braille readers, remains limited due to high costs and technological constraints. Devices like the Chameleon 20, priced at \$ 1,715 (approximately R 31,723 in South Africa), pose financial barriers for individuals, educational institutions, and governments in low-income regions. Geomorphic tactile displays offer a potential breakthrough in affordability and functionality. This paper examines their financial viability and transformative potential in both developed and emerging markets.

2. Theoretical background

To create a digital device display that can manipulate the geomorphic properties of ferrofluids which can be used to display text and images in 3D or rather 4D if you include the sense of touch with respect to time. Theoretically it would be possible to practically demonstrate how ferrofluids can be manipulated. Using this knowledge the final goal is to create a geomorphic digital display for application in modern devices such cell phones, laptops, TVs becomes a possible reality, this would be highly beneficial for all types of users including visually impaired persons that want to learn how to read braille or the advanced braille reader who want to have access to thousands of books all on one device, removing the clutter and costs of purchasing hardcopy braille books, or for institutions that have high volumes of educational materials, like libraries and specialised schools.

Programming Methods that use AI algorithms can be useful tools for an easier smoother interface with all data points in the fluid making it easier to program track, model, trouble shoot, update and modify the device is in its development and testing phase.

Since frequency and geometric shapes are related through standing waves, which are invisible patterns that occur when waves reflect and pass through each other. These patterns are made up of zones of vibration and points of no vibration that remain stationary while the electric field is present. Changing the frequency will also change emergent pattern.

Comparative use cases and accessibility:

- *Standard smartphone users.* Integrating geomorphic tactile displays provides users with a novel way to interact with data. Examples include:
 - 3D tactile maps for navigation.
 - Interactive shapes for gaming and design.
 - Textures for immersive reading or education.
- *Visually impaired users.* The primary audience for tactile technology stands to gain the most.
- *Enhanced accessibility.* Real-time Braille rendering and tactile imagery bridge gaps in digital literacy and accessibility.

3. Research methodology

The research aims to develop a ferrofluid-based tactile display that allows visually impaired users to perceive and interact with visual information through touch. Ferrofluids, which respond to magnetic fields, can be manipulated to form physical shapes or patterns. This research seeks to explore how ferrofluids can be effectively used to create tactile representations that are both perceivable and meaningful for users with visual impairments.

3.1. The research objectives of the present study are:

Objective 1: Comparative Cost Analysis: Current Devices vs. Enhanced Smartphones

Objective 2: To design and develop a prototype tactile display using ferrofluids.

Objective 3: To investigate the optimal magnetic field configurations that enable ferrofluids to form stable and perceivable tactile shapes.

Objective 4: To evaluate the effectiveness of the tactile display in conveying visual information through touch.

Objective 5: To assess the usability and user experience of the ferrofluid display for visually impaired users.

3.2. Research design. A mixed-methods approach will be used, combining experimental design, usability testing, and qualitative interviews to evaluate the effectiveness and user experience of the ferrofluid-based tactile display.

3.3. Prototype Development

Materials and Components:

- **Ferrofluid:** A colloidal liquid made of nanoscale ferromagnetic particles suspended in a carrier fluid.

- **Magnetic Field Generators:** Electromagnets or permanent magnets to control the shape and movement of the ferrofluid.
- **Tactile Surface:** A smooth, non-magnetic surface that allows users to feel the ferrofluid shapes without interference.
- **Control System:** A micro-controller or computer interface to manipulate the magnetic fields and change the ferrofluid patterns.

Design and Fabrication:

- Develop a display surface where ferrofluids can be manipulated into different shapes or patterns.
- Integrate a magnetic field control system to dynamically change the ferrofluid shapes.
- Ensure that the tactile display is safe and comfortable for users to touch and interact with.

3.4. Magnetic Field Configuration

Experimental Setup:

- Test various magnetic field strengths, orientations, and configurations to determine the best conditions for creating stable and distinguishable shapes.
- Use simulations and physical experiments to optimize the magnetic control system.

Measurements:

- Measure the stability, size, and sharpness of ferrofluid shapes under different magnetic conditions.
- Evaluate how different patterns (e.g., lines, dots, complex shapes) can be formed and maintained over time.

3.5. User Testing and Evaluation

Participants:

- Recruit visually impaired individuals of varying ages and levels of visual impairment.
- Include a diverse sample to account for different levels of tactile sensitivity and experience with tactile displays.

Testing Procedure:

- Introduce participants to the ferrofluid display and provide instructions on how to explore the tactile patterns.
- Present a series of tasks where participants must identify, differentiate, or interpret tactile shapes and patterns.
- Record feedback on ease of use, comfort, and perceived effectiveness of the display.

3.6. Data Collection

Quantitative Data: Measure task performance metrics such as accuracy, speed, and error rates.

Qualitative Data: Conduct semi-structured interviews to gather participants' experiences, preferences, and suggestions for improvement.

3.7. Data Analysis

Quantitative Analysis:

- Use statistical methods to analyse task performance data.
- Compare different magnetic configurations and their impact on shape recognition and tactile feedback.

Qualitative Analysis:

- Perform thematic analysis of interview transcripts to identify common themes, challenges, and user preferences.
- Synthesize qualitative feedback to guide further development and refinement of the display.

3.8. Iterative Design and Prototyping

- Based on the initial user testing results, refine the prototype to address any identified issues.
- Implement changes to improve the usability, comfort, and effectiveness of the tactile display.

- Conduct additional rounds of testing with new participants to validate the improvements.

3.9. Ethical Considerations

Informed Consent: Ensure that all participants are fully informed about the research objectives and procedures before participating.

Anonymity and Confidentiality: Protect participants' identities and personal data throughout the research process.

Accessibility and Safety: Ensure that the tactile display is designed with safety and accessibility in mind, avoiding any risks to participants.

3.10. Expected Outcomes

- A functional ferrofluid-based tactile display that can form stable and recognizable shapes.
- Insights into the optimal magnetic field configurations for tactile shape formation.
- Positive feedback from visually impaired users regarding the display's effectiveness and usability.

3.11. Limitations and Future Research

Limitations:

- Potential challenges in maintaining consistent shape fidelity due to the nature of ferrofluids.
- Variability in users' tactile perception, which may affect the generalizability of results.

Future Research:

- Explore more advanced control systems for finer shape manipulation.
- Investigate the integration of auditory or haptic feedback to enhance the user experience.

4. Findings

4.1. Comparative Cost Analysis: Current Devices vs. Enhanced Smartphones

4.1.1. High Costs of Traditional Devices

Current Braille devices and smartphones tailored for the visually impaired, such as the Orbit Reader 20 and Chameleon 20, are prohibitively expensive. Producing these devices involves specialized components and low-volume manufacturing, which inflate costs. For example:

Orbit Reader 20: \$ 699

Chameleon 20: \$ 1,715

The Chameleon's 20-cell refreshable braille display and Perkins-style keyboard provide a comfortable reading and writing experience. Superior internal intelligence and multiple modes of connectivity allow students to use the Chameleon as a stand-alone notetaker, or as a braille display to edit assignments on the computer.

Educational institutions serving visually impaired students often face budget constraints, limiting accessibility and hindering literacy development.

4.1.2. Current Costs of Benchmark Devices

1. iPhone 15 Pro

- Base Model Price: \$ 999 approx. R 18,000 in South Africa
- Advanced hardware and high consumer demand contribute to this pricing.

2. Samsung Galaxy Z Flip 5

- Base Model Price: \$ 999
- Known for its foldable display, the Galaxy Z Flip demonstrates the market's appetite for innovative yet premium-priced features.

4.2. Hypothetical Cost Impact of Geomorphic Integration

The addition of geomorphic tactile display technology could introduce the following cost factors:
Ferrofluid and Magnetic Systems: Material costs for Ferrofluid are scalable but could initially add \$50–\$100 per device during early adoption stages.

Software and AI Development: Custom algorithms for managing tactile displays may increase development costs, adding an estimated \$20 – \$50 per unit.

Manufacturing Adjustments: Integration of geomorphic systems into existing production lines could increase costs by \$30 – \$70 per unit in the short term but decrease with mass adoption.

Estimated Additional Cost: \$100 – \$200 per smartphone in early adoption stages, reducing over time due to economies of scale.

4.2.1. Economic Viability of Geomorphic Smartphone Displays

Financial Advantages

1. *Multi-Purpose Functionality.* Integration into smartphones eliminates the need for separate Braille devices (e.g., \$1,715 Chameleon 20), creating significant cost savings for users and institutions.

2. *Market Expansion.* Inclusion of tactile displays in mainstream smartphones makes the technology universally available, increasing demand across consumer segments and fostering innovation.

3. Mass Production Efficiencies

- High production volumes reduce per-unit costs over time.
- Similar trends in display technology (e.g., foldable screens) suggest a rapid cost curve improvement for geomorphic systems.

Market Dynamics: Smartphones with Geomorphic Displays

Market Growth Potential: Smartphones with geomorphic tactile displays could cater to both mainstream and specialized markets.

Premium Tier: Positioned alongside flagship devices, appealing to early adopters and accessibility advocates.

Mass Adoption Tier: Gradual price reductions enable penetration into mid-range markets, enhancing universal accessibility.

Challenges in Pricing Accessibility

Emerging Markets: Initial costs may remain prohibitive for consumers in low-income regions. Governments or corporations may need to subsidize devices to ensure accessibility.

Comparative Market Analysis & Smartphone Market Potential

Global smartphone shipments in 2023 reached over 1.2 billion units, with a projected compound annual growth rate (CAGR) of 6.8% through 2030.

Introducing geomorphic tactile displays as a standard feature could create a new premium segment, boosting revenue for manufacturers while enhancing inclusivity.

Cost to Value Proposition

Geomorphic displays enhance value for both visually impaired and general users, justifying a moderate price increase for added functionality.

Institutions, particularly in education and healthcare, may prioritize such devices for inclusive accessibility.

Broader Reach: Unlike niche features like foldable displays, tactile technology benefits all users, especially the visually impaired, offering greater market appeal.

Cost Reduction: By consolidating functions into a single device, users save thousands of dollars currently spent on separate Braille devices.

Institutional Use

Educational institutions, libraries, and organizations could benefit from mass adoption.

Economic Efficiency: Equipping classrooms or training centres with geomorphic smartphones reduces costs compared to standalone devices.

Inclusivity in Learning: Tactile displays democratize access to content, improving literacy and vocational training for visually impaired students.

Competitive Edge for Manufacturers

Differentiation: Manufacturers that adopt tactile technology early gain a competitive edge in both premium and accessibility segments.

Brand Equity: Offering inclusive technologies enhances reputation and fosters brand loyalty among a diverse customer base.

4.2.2. Financial Modelling: Long-Term Cost Efficiency

Economies of Scale

Initial Costs: Higher due to R&D and manufacturing retooling.

Projected Reduction: Costs drop by 30 – 50% over five years as production scales and material sourcing improves.

Cost Savings for Users

Example Scenario:

Current Cost for Braille Device + Smartphone: approx. \$2,700 (\$1,700 for Braille device + \$1,000 for smartphone).

Geomorphic Smartphone Cost: approx. \$1,200 – 1,400 (Initial premium of \$200 for tactile tech, reducing over time).

Net Savings: \$1,300 – 1,500 per user.

Revenue Opportunities

Hardware Sales: New markets emerge as tactile displays appeal to general consumers and niche audiences alike.

Software Ecosystem: Subscription-based apps utilizing tactile features (e.g., 3D tactile books or training simulations) create recurring revenue streams.

Emerging Market Accessibility & Subsidy Models

Governments and organizations could subsidize devices to enhance accessibility for low-income groups, particularly in developing nations.

Potential Cost to Governments

Subsidizing approx. \$300 per device for visually impaired users.

Economic Return

Increased productivity and reduced social welfare dependency could offset subsidy costs over time.

Local Manufacturing and Job Creation

Encouraging local assembly of geomorphic-enabled smartphones could drive economic growth in developing countries.

5. Conclusion

Incorporating geomorphic tactile displays into smartphones promises to redefine accessibility and interaction across demographics. When benchmarked against devices like the Orbit Reader 20, Chameleon 20, Orbit Reader 20, iPhone 15 Pro and Samsung Galaxy Z Flip, tactile geomorphic display technology demonstrates comparable cost implications with broader user benefits. Over time, reduced costs, mass adoption, and expanded markets could establish tactile geomorphic displays as a standard feature in many smart devices, delivering profound economic, social, and technological value.

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Section III

Economic and Social Studies

An Analysis of the Web Visibility of Non-Tertiary Educational Institution in Romania

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Abstract

This paper analyzes the web visibility of non-tertiary educational units in Romania, considering the factors that influence their online presence, especially in light of the COVID-19 pandemic, which underscored the importance of digital connectivity in education. The data used were retrieved from data.gov.ro, selecting characteristics such as property type and area of residency. The results obtained reveal a higher prevalence of websites in urban educational units and among the public ones. The Mann-Whitney U-test indicates newer websites in rural areas, highlighting recent digital advancements. These differences in digital presence reveal a potential gap in resource allocation and technological support between urban and rural educational units. These findings could provide a foundation for policymakers to support digital access among Romanian educational units.

Key words: non-tertiary education, school websites, web visibility, digital presence, educational units

J.E.L. classification: I29

1. Introduction

Schools are no different today compared to 1600, teaching students to provide a model answer rather than innovate (Seldon et al, 2020 p.10, 33). Technologies developed since 1960 such as photocopiers, computers and smartboards improved students' experience in accumulating knowledge (Seldon et al, 2020 p. 25), yet, in the advent of the AI, education should focus on developing all human intelligences, foster curiosity and create learning opportunities from anywhere (Seldon et al, 2020 p. 209). A school website, might be used as a tool in this respect, yet the website must incorporate engaging communication tools and must focus on the individual (Istifadah et al 2019, p. 411). Moreover, a school website communicates the school's mission its approach on learning and its vision on academic achievement (Wilson and Carlsen, 2016, p. 24). Also, it functions "as a support structure for policies and diversity (where diversity refers to the specialisation and division of educational provision)" (Wilkins, 2012 p. 83).

Regarding contents, a school website must provide relevant information on a regular basis (Tubin and Klein, 2007 p. 203). Elements such as teachers' e-mail address, class information, office hours, lecture notes, student work samples and administration news must be included (Unal, 2008 p.47). Also, school website may be used to improve communication with the parents via calendar updates, recruit volunteer parents for various school activities and enhance participation in school life via forum (Piper, 2012 p.36-38). Furthermore, if carefully designed, a school website might serve as a marketing tool to attract prospective students (Álvarez-Álvarez and Ines-Garcia, 2016 p.10) and can be combined with other social media platforms such as YouTube into a management information system (Marpaung and Sazali, 2022 p. 164).

Given the importance of a school website, the present paper aims to assess the web visibility of schools in Romania. More specifically, the following questions will be addressed:

- Q1. What are the main characteristics of the educational units that have a website in Romania?
- Q2. Is there a difference in the number of days a website of an educational unit has been running by type of property of the educational unit?
- Q3. Is there a difference in the number of days a website of an educational unit has been running by area of residency of the educational unit?

2. Literature review

During the COVID-19 pandemic, the “digital divide that parallels the educational divide” among students could be observed all over the globe (Darling-Hammond et al 2020 p. VI). In this context, it became imperative that schools connect with families via web-based platforms on a regular basis and ensure an interactive and authentic online learning experience (Darling-Hammond et al 2020 p. 52,11).

School websites became more than an informative tool during the pandemic. For example, many schools offered information about mental health issues related to COVID-19, remote counselling and directions for students experiencing a crisis via their website (Seidel et al 2020, p.1261). Moreover, beyond school websites, many teachers developed online classrooms, more specifically a website that “is intended as a special space between teacher and student so that features in it are adjusted based on the limitations of students and subject matter” (Halent et al. 2020 p. 48). Also, educational websites aimed at offering support in learning via interactive exercises and pedagogical guidance were extremely useful during the lockdowns (Rhazal et al. 2022, p.16) and they often became an alternative to direct instruction (Yildirim and Guleroglu 2022, p.1).

In vocational learning, the COVID-19 pandemic highlighted the need to implement digital solutions (Nurfitria et al. 2021 p.194). In this respect, a website-based green school combining distance learning and instruction practices oriented towards care for the environment can be adopted (Nurfitria et al. 2021 p.196).

3. Research methodology

For the purpose of this paper data for each non-tertiary educational unit was retrieved from data.gov.ro on June 12th 2024. The reference school year is 2022-2023. The following variables were defined: area of residency – states whether the facility is located in an urban or a rural territorial unit; property type – states whether the facility is public or private; level of education – states the level of education for which a facility is authorised to function (an educational unit may operate multiple levels: ante-pre-scholar, pre-scholar, primary, lower secondary, upper secondary, upper secondary and non-tertiary, professional); a dummy variable stating whether the school has a website (value = 1) or not (value = 0); age of website in days (number of days between June 12th 2024 and the day the website was launched).

In order to answer the first research question, a graphical analysis was performed. For the second and third questions the Mann-Whitney U Test was used. Based on Iuliano and Franzese (2019 p.666), the null hypothesis of the test was formulated as follows:

For Q2: Median of Age of website (days)_{private units} = Median of Age of website (days)_{public units}

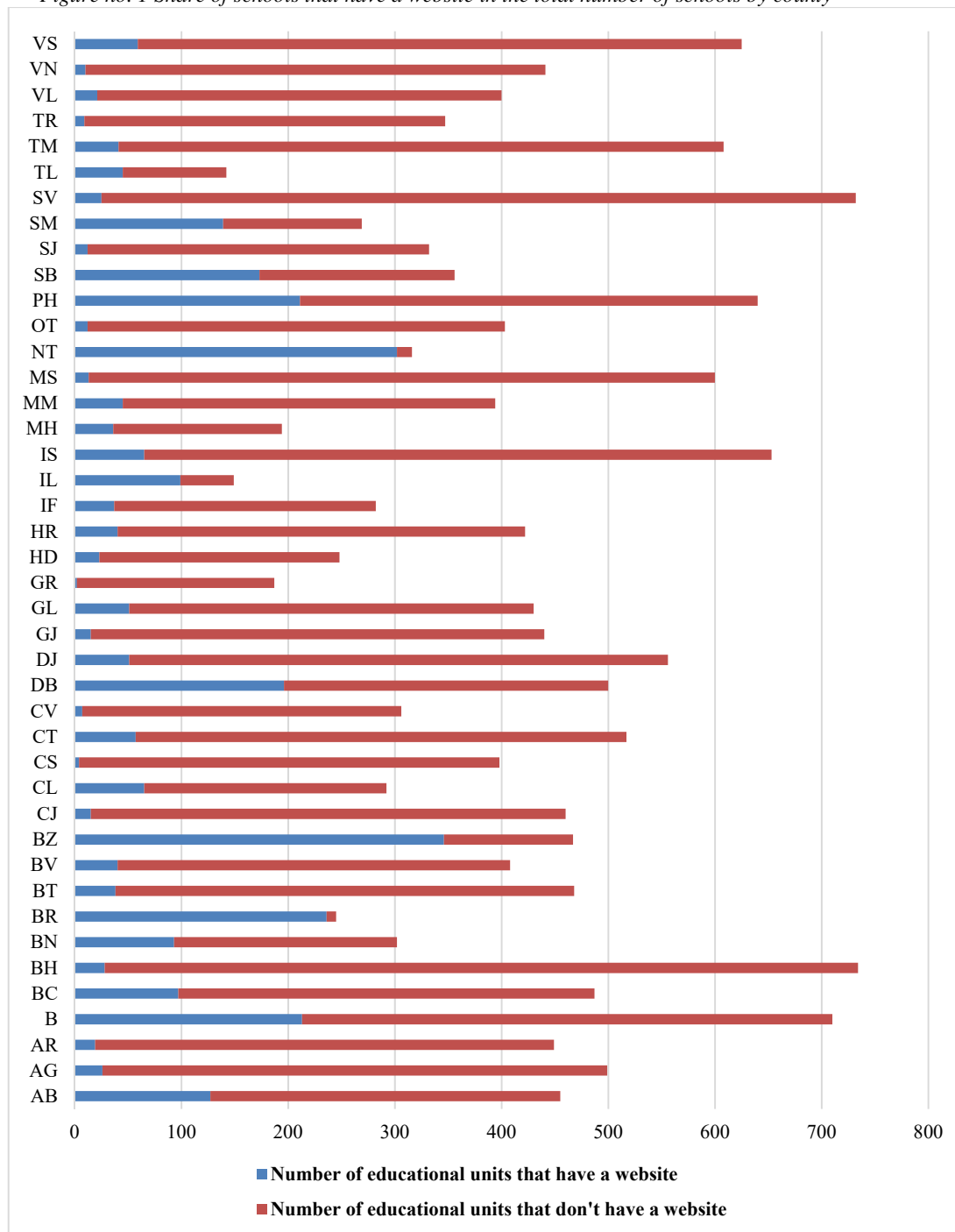
For Q3: Median of Age of website (days)_{urban} = Median of Age of website (days)_{rural}

The observations can be considered independent, as each educational unit is free to decide whether to have a website or not. Moreover, the boxplots are presented together with the test results, as this is useful to observe the spread as well median itself (McIntosh et al., 2010 p.181). The computations were performed using the R-Shiny web application developed by Mizumoto, A. (2015). The significance level was 5%.

4. Findings

Figure 1 shows the share of schools in the total number of schools that have a website by county. Braila has the highest share of schools with a website (96.3%), Caras-Severin has the lowest share (1%).

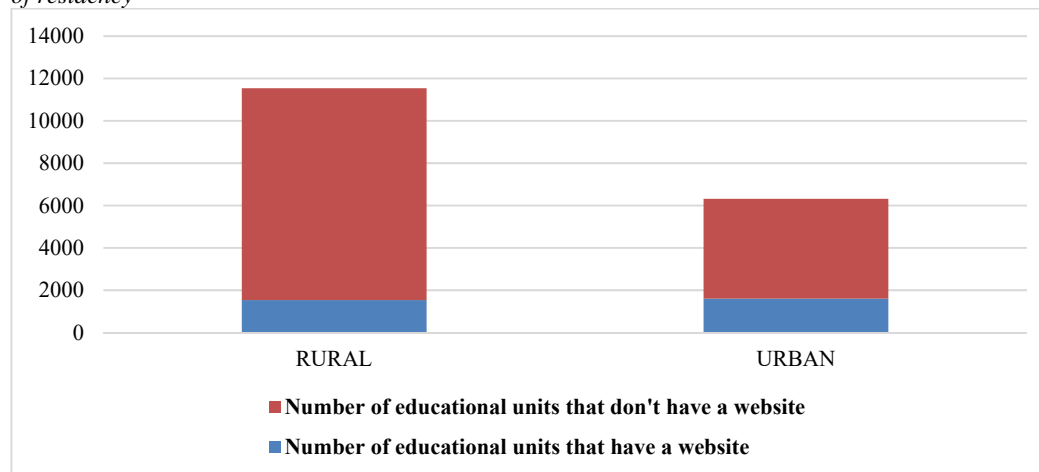
Figure no. 1 Share of schools that have a website in the total number of schools by county



Source: designed by the authors based on data from data.gov.ro

Figure 2 displays the share of schools that have a website in the total number of schools by area of residency. In urban areas there are more schools with a website both in terms of absolute and relative numbers.

Figure no. 1 Share of educational units that have a website in the total number of educational units by area of residency



Source: designed by the authors based on data from data.gov.ro

Considering the educational level and authorisation status, the highest number of educational units that have a website offer lower secondary educational services (table 1). Moreover, most of the educational units that have a website function based on full authorisation.

Table no. 1 Number of educational units that have a website and the total number of educational units by level of education and authorisation

	Number of Educational Units that Have a Website	Total Number of Educational Units
Ante pre-scholar		
Full authorisation	44	245
Authorisation	13	85
Pre-scholar		
Full authorisation	1401	4998
Authorisation	46	329
Primary		
Full authorisation	1510	4758
Authorisation	20	107
Lower secondary		
Full authorisation	1591	4962
Authorisation	29	88
Upper secondary		
Full authorisation	681	1482
Authorisation	16	75
Upper secondary non-tertiary		
Full authorisation	273	704
Authorisation	41	105
Professional		
Full authorisation	405	950
Authorisation	19	40

Source: designed by the authors based on data from data.gov.ro

Table 2 displays the number of educational units that have a website and the number of educational units that don't have a website by property type. Approximately 20% of the private educational units and 17% of the public ones have a website. Additionally, most of the educational units that have a website are public ones.

Table no. 2 Number of educational units that have a website and number of educational units that don't have a website by property type

	Number of school that have a website	Number of school that don't have a website
Private	209	813
Public	2934	13907

Source: designed by the authors based on data from data.gov.ro

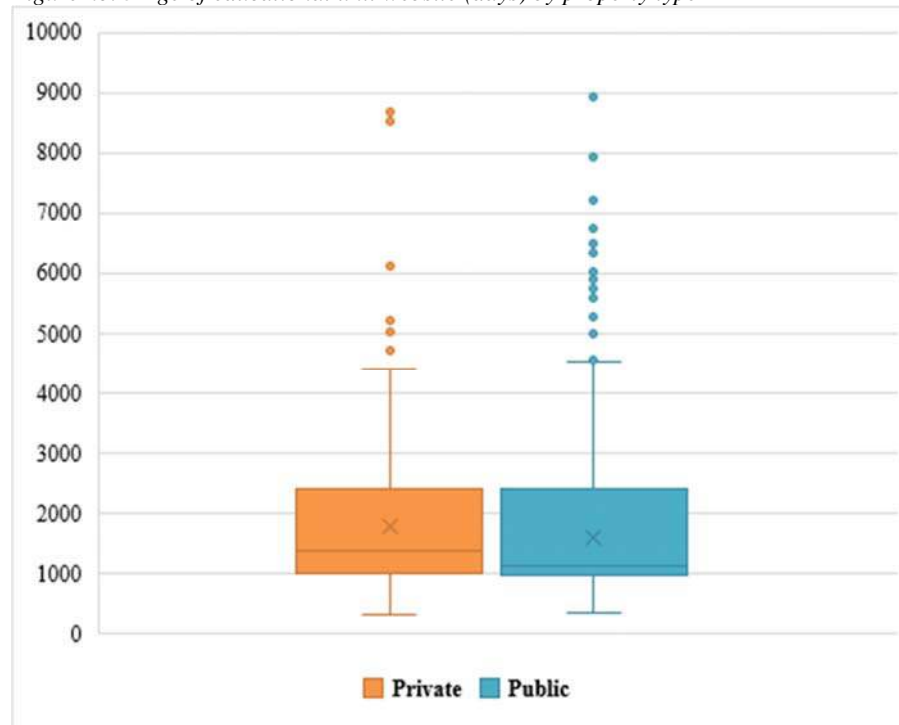
Next, the results of the Mann-Whitney U-test together with boxplots are presented. Table 3 displays the rank results and p-value for the test conducted on the Age of website variable by property type (private/public) and figure 3 represents the boxplot for the same variable by these categories. At 5% significance level, it can be concluded that there is no significant difference in the age of website by property type. Indeed, based on the boxplots, the two distributions are similar.

Table no. 3 Mann-Whitney U-test results – Age of educational unit website (days) by property type

Rank Results		
Property type	n	Rank Mean
Private	209	1677.28
Public	2933	1563.96
p-value=0.08076726		

Source: designed by the authors based on data from data.gov.ro using Mizumoto, A. (2015). Langtest (Version 1.0) [Web application]. Retrieved from <http://langtest.jp>

Figure no. 3 Age of educational unit website (days) by property type



Source: designed by the authors based on data from data.gov.ro

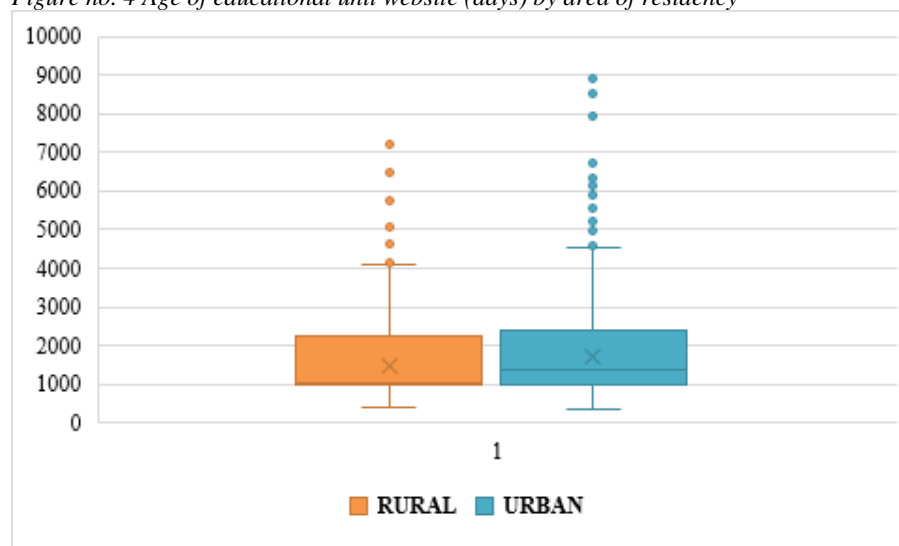
Table 4 displays the rank results and p-value for the test conducted on the Age of website variable by area of residency (urban/rural) and figure 4 represents the boxplot for the same variable by these categories. At 5% significance level, the null hypothesis is reject, thus there is a significant difference in the age of website by area of residency. The rank mean is lower for educational units in rural area. This means that schools in rural areas have newer websites. This result is confirmed by the medians of this variable by the two categories.

Table no. 4 Mann-Whitney U-test results – Age of educational unit website (days) by area of residency

Rank Results		
Area of residency	n	Rank Mean
Private	1535	1500.61
Public	1607	1639.21
p-value = 1.831585e-05		

Source: designed by the authors based on data from data.gov.ro designed by the authors based on data from data.gov.ro using Mizumoto, A. (2015). Langtest (Version 1.0) [Web application]. Retrieved from <http://langtest.jp>

Figure no. 4 Age of educational unit website (days) by area of residency



Source: designed by the authors based on data from data.gov.ro

5. Conclusions

The findings on the web visibility of Romanian non-tertiary educational institutions shows that urban and public institutions are more likely to have established websites, with rural ones exhibiting newer digital infrastructure. Although no notable differences were found in website longevity based on the type of ownership, rural institutions typically have newer websites, reflecting recent advancements in digital inclusion efforts and with 20% of private educational units maintaining a website compared to 17% of public ones. In Brăila County, 96.3% of schools have a website, while in Caraș-Severin, only 1% of schools have an online presence.

The COVID-19 pandemic has affected educational systems worldwide, including Romania. The sudden shift to remote learning forced educational institutions to adopt fastly a digital solutions to maintain communication between teachers and students. This situation revealed the importance of web visibility for non-tertiary educational units, as many faced significant challenges in staying connected with students and parents.

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Navigating ChatGPT for Business English Writing: Benefits, Limitations, and Challenges for Students

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Abstract

The present study explores the use of ChatGPT as a tool for enhancing Business English (BE) writing skills among first-year students in a Finance and Banking program. A number of 24 students participated in a qualitative experimental approach in which they wrote a complaint letter, comparing their own versions with those generated by ChatGPT 4.0. The feedback collected from students revealed that while it was felt that ChatGPT produced well-structured and professional letters, student's own writing was more creative, with a strong personal voice, despite the limitations of the BE writing in terms of creativity. The study emphasizes AI's impact on helping students refine their writing mechanics, while preserving a critical perspective on the model's limitations in terms of creativity, larger understanding of external contexts and emotional connection in writing.

Key words: AI tools, ChatGPT, teaching Business English, writing skills, Business English learning.

J.E.L. classification: Z13

1. Introduction

Chat GPT, developed by Open AI, is presented as an advanced conversational AI model which is created to generate human-like text from the input it receives. Its developers present it as being capable to engage in conversations, make recommendations, answer questions, and help with creative writing, as well as other tasks. It offers instant essential feedback and revisions to its users, helping them overcome difficulties in terms of adopting a formal register, specific vocabulary, and business specific writing conventions, through its functions it represents a promise to bridge the gap between traditional academic learning forms, real professional world conventions and students' expectations to include digital technology in their daily activities. It is capable to continuously learn from user interactions and understand language nuances as it is meant to adapt to specific needs in terms of tone, style, language register. Users have noticed that this tool presents limitations in terms of information accuracy and nuanced reasoning.

Considering that ChatGPT can be used as a flexible and personalized tool which can teach users to effectively organize information, focus on key points, familiarize with industry specific jargon, cultural nuances and formatting solutions, our purpose in the present paper is to explore part of the potential of this tool in terms of increasing business writing skills and writing proficiency for our students.

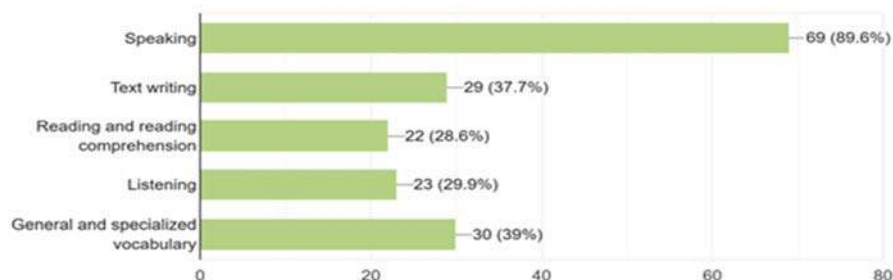
Business English writing is a key competence for effective communication in the preset globalized business environment. Mastering these skills helps interact with professionals and partners across the globe with clarity, precision, and professionalism. Apart from playing an important role in increasing productivity and avoiding misunderstandings, well-written documents prove competence, create a positive impression, build trust and credibility. Therefore, mastering BE writing represents an asset in career advancement. Moreover, the results of a needs analysis survey carried out on 77 students enrolled in the first year at the Faculty of Economic Sciences at "Ovidius" University of Constanța, at the start of the second semester of the academic year 2022-

2023, indicate the options of students in terms of the skills to be improved to be successful in their future careers. As we can see from Figure no. 1 below, text writing ranks second, with almost 40% of the options expressed.

Figure no. 1 Skills to be improved for a successful future career

13. Which of these skills will be of great use for you in your future career? Choose the two most important ones.

77 responses



Source: (Bacă, E., Popescu A, 2024, p. 89).

As AI tools available for writing assistance are more and more numerous, continuously evolving and focused on different needs: for grammar and style correction, and content optimization, most of them offer cohesion and correction advice, considerably contributing to the overall quality of the final product. The entire writing process can be speeded up using AI, repetitive tasks such as drafting standard emails or generating business reports, various types of business letters, which traditionally consume time and resources are now handled by AI. As a result, the overall productivity can be improved, and resources allocated more efficiently. Streamlining the, sometimes, strenuous writing process with automated grammar correction, organizational or content/style suggestions, enables employees to produce high-quality content while saving time (Vassallo P., 2024, p.360). Consistency across documents and other forms of communication can be reached, enabling businesses, at the same time, to quickly adapt to increasing global demands, staying ahead of competition, and minimizing the cognitive workload of its employees.

While the advantages of using AI tools in streamlining writing tasks are more obvious, there are concerns regarding an increasing amount of over-reliance on technology, as employees become more dependent on AI for these tasks, and not only hinder, but also lose their already acknowledged writing abilities. Another aspect is related to losing critical thinking abilities, this, in time, can result in losing one's self-confidence and the capacity to write autonomously and creatively, while the real attributes of authorship seem to be lost forever. AI assistants can replace the instructors in various forms of blended learning, creating more autonomous forms of learning, in which students can experience future jobs possible scenarios. (Popescu A., 2022, p. 410).

AI powered writing tools are capable to offer personalized feedback based on a quick analysis of writing styles, helping users nuance their communication. Moreover, efficiency is reached in terms of not wasting time and resources on repetitive, boring tasks and focusing on other aspects which require creative immediate human interaction, such as building relationships with the business environment, crafting business strategies and issuing creative business proposals.

2. Literature review

Opinions on the usefulness of ChatGPT vary, therefore, hot debates are centered on foreseeing whether it will be a real breakthrough and in what respect. One of the first 'victims' is writing-tightly connected to researching, reflecting, organizing a text, to make it as persuasive as possible. Instead of this strenuous process, taking hours or days in some cases, AI tools deliver a plausible-sounding text on any topic, which can be transformed in various registers similarly to a Lego game.

In an interview on 20th January 2023, Noam Chomsky defined GPT as "basically high-tech plagiarism" and "a way of avoiding learning", which feeds on vast amounts of data and groups them together miming the real process of writing (Chomsky N., 2023). In January 2025, speaking about the prospective developments of ChatGPT, Sam Altman referred to its unprecedented growth trajectory which impacted the world at large, announcing greater advancements on the horizon, superintelligence "in the true sense of the word" being ready in 2025 to "join the workforce" and change the production of companies (Altman S., 2025).

The present studies based on using AI tools for teaching business English writing skills indicate that it can enhance language refinement for L2 learners (Lee G., 2024, p.134), considerably improve writing outcomes for students (Oktarina et al., 2024), it can bring significant advancements in grammar and composition, by providing instant assistance. It reduces cognitive strain and encourages us to focus on creativity and content flow (Arora A.P., 2024, p. 102).

While researchers indicate ChatGPT as an effective tool for formal education, students consider that it is an outstanding resource for English learning in a formal setting (Mulia, Piri & Tho, 2023, p. 387) and they describe it as functional, efficient, user friendly, timesaving. Ai tools enhance students' communication skills, preparing them for multicultural workplace challenges by allowing them to navigate various international scenarios (Mustafa F. et al., 2024, p.66). Other studies indicate that while ChatGPT can generally enhance writing proficiency, its impact in terms of more creative forms of writing, such as essay writing, is less impressive than expected, as a result, more training in AI tools management and further research on its uses is recommended (Aglibot K.A. et al., 2024, p. 175). It is equally important to note that while the information provided by AI systems seems abundant and well organized, it is not always accurate, current, or complete. Other concerns indicate loss of creativity risks, data privacy risks, and digital literacy problems, as issues to be considered by educators.

In contemporary rapidly and continuously evolving global landscape, prioritizing AI literacy among students is crucial. From here derives the need to implement adequate AI course for educators, which is a process in progress in Romanian academic systems. This literacy encompasses the understanding of basic components such as application, authenticity, accountability, and agency (Cardon P. et al., 2023, p.290). By doing this, instructors equip their students with a critical and responsible attitude towards AI, such an attitude plays an important role in students' future success in the workplace, considering the quick development of AI assistants, as more and more industries are expected to adopt and implement these technologies.

3. Research methodology

The present study is part of a larger research project to be developed, and adopts a qualitative experimental approach meant to evaluate the possible effectiveness of ChatGPT technology in improving BE writing skills in academic education. The decision to use the present design is based on the necessity to develop writing skills (as indicated by Fig. 1, see above) and allows for a controlled investigation on how AI systems can be beneficial by delivering automated feedback, correcting mistakes, and providing tailored recommendations. The research participants are a group of 24 students enrolled in the 1st year, Finance and Banking program, at the Faculty of Economic Sciences, "Ovidius" University of Constanta.

The initial step of the experiment comprised an introductory session in which students were briefly introduced to the AI systems, exposure to the given writing task and to ChatGPT. In the second stage students were invited to elaborate their own response to the following writing task:

- Based on the following situation (*You recently noticed an unauthorized transaction on your bank account. Despite notifying the bank promptly, they have not taken adequate action to resolve the issue, leaving your funds unrecovered*). Write a letter of complaint.
- Compare the two versions of the letter and answer the following questions:
 - a) Which version do you consider to be better?
 - b) Which version would you have liked to receive? Why?

In the third stage, students asked ChatGPT to provide its version for the same given topic, and then, students answer the questions above. The data was collected and analyzed by the course instructor.

4. Findings

Analyzing the versions of the complaint letter of ChatGPT, we noticed that structurally they were identical, however, they slightly differ in tone and urgency conveyed. Compared to students' letters which are very different in terms of structures used, vocabulary and grammar knowledge, choice of tone and level of urgency conveyed. The common structural elements of ChatGPT's versions share an introduction with a polite greeting, an issue descriptions section which explains the basic problem (an unauthorized transaction detected at a particular date and a lack of resolution, despite reporting the issue to the bank), a request for action (specific to the necessities of the issue-recovering funds, providing an update or escalating the matter), and a conclusion with a polite closing. The ChatGPT versions we analyzed share several common vocabulary structures, the recurring phrases and vocabulary used to reinforce professionalism, clarity, and expectation of timely action.

Students' comments related to the questions received as part of the second step of our investigation relate to humans being indispensable in terms of creativity and depth of understanding a larger situation, placing the text in a larger socio-economic context, factual accuracy judgement, providing more reliable information derived from external factors, human connection and empathy, unicity of writing style and voice. They also stressed the role of AI systems as a valuable support for humans. Here are some of their opinions:

- „I looked at my mates, and some of the answers we got from GPT to our task were quite similar, ours are way more different in terms of structure, vocabulary, they reflect us more and less the writing rules. I like mine, but I like its vocabulary...”
- "AI writing feels like it's missing a soul, it's perfect, I admire it for that, if the text has errors or is clumsy, I know it's human. We know how to put heart into our work."
- „We have less vocabulary and structure compared to AI, but the text is more alive, if I may say so...”
- "We know how to add a personal touch that makes our writing feel real, something AI can't do. I would have liked to receive mine, as it is more human."
- "Our experience in business writing allows us to connect with readers in ways AI can't. I like my writing, it means someone spent time writing it and thought about me, the reader."
- "AI can write well, but it misses the warmth and empathy, or the sorrow we bring to our work. I don't mind receiving AI written business letters."
- "When we write, we reflect on the impact of our words, but AI just writes a text, it's an industrial product!"
- "We can anticipate the needs of our audience, while AI just follows patterns. Humans are unpredictable, so I like humans. "
- "We can adjust our tone depending on the audience, which AI struggles to do, but I think in the future AI will improve, so now I like my letter, but in the future.... I don't know..."
- "I like human letters, because we can put creativity and humor into our writing, which AI can't really do naturally."

5. Conclusions

The findings of the present study indicate that ChatGPT is a useful tool which can be used to enhance the aspects of BE writing connected to grammar, vocabulary, the overall structure of the business text and clarity. Students acknowledged and appreciated AI's capacity to generate professional texts, which saved time and reduced human cognitive load. Nevertheless, they noticed that it lacks creativity, personalization of the output and emotional involvement which can be perceived from the human writers' texts. While the output of ChatGPT was unanimously indicated as being excellent in terms of consistency and clarity, students felt that their own versions of the letter reflected their unique voices and connected to the reader at a personal level. Overall, AI is a

valuable support tool in the learning process of the mechanisms of writing, but it needs to be "enriched" with nuanced, creative, and empathetic "human touch", the author's presence to be felt behind the text.

Apart from enjoying the advancements of these instruments, it is of equal importance to be aware of their potential limitations. By understanding AI's applications and possibly temporary limitations (considering the promises of more amazing future advancements of such technologies), students can responsibly and confidently navigate and accommodate the possible challenges and opportunities that these technologies bring into our existence, especially in our professional environment.

In terms of future research in this field, given the rapid developments of AI technologies and their increasing presence in educational environments, we can foresee a focus on areas such as: longitudinal studies (which can provide feedback on students' evolution while being continuously exposed and becoming more proficient in using AI, with an emphasis on the evolution of their creative and critical thinking abilities); comparative studies (researching in a comparative manner other writing AI aids, which could help educators in their future decisions concerning the choice of AI to be used and its complementarity with traditional methods of teaching); AI personalized forms of learning (which offer tailored feedback and recommendations based on each student's learning approaches). All these areas can help develop and reshape the way in which we teach and learn writing skills, while making this process more dynamic and better centered on the learner.

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Optimizing Energy Storage Systems. A Dynamic Framework For Capacity Allocation And profit Maximization In Electricity Markets

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Abstract

This paper presents an algorithmic approach for optimizing energy storage system (ESS) capacity allocation across multiple electricity markets to maximize profits. The methodology involves collecting real-time and historical data on market prices, renewable energy forecasts and grid demand. Predictive analytics, including machine learning models, forecast future market conditions, while optimization techniques such as mixed-integer linear programming (MILP) determine the optimal schedule for charging and discharging. Reinforcement learning (RL) is integrated into the framework to enable dynamic, adaptive decision-making, allowing the ESS to continuously refine its market strategies. Key constraints such as storage capacity, charge/discharge rates and market regulations are incorporated into the model. A feedback loop ensures real-time adjustments based on market fluctuations, improving profitability over time. Revenue stacking across day-ahead, intra-day, ancillary and balancing markets further enhances the financial viability of ESS investments.

Key words: energy storage systems, energy transition, operation strategy, algorithmic approach, optimization

J.E.L. classification: O13, P18, G14

1. Introduction

Energy storage systems (ESS) have an important role in electricity markets, enabling flexible grid management and enhanced renewable energy sources (RES). As electricity markets become more decentralized and RES proliferate, ESS have emerged as essential assets for balancing supply and demand, ensuring grid stability and providing ancillary services. However, effectively managing ESS across various markets requires a decision-making process to maximize profitability while adhering to operational and regulatory constraints. Participants can access a range of opportunities, including day-ahead markets (DAM), intra-day markets (IDM), ancillary services markets (ASM) and balancing markets (BM). Each market offers unique benefits and risks, driven by factors such as price volatility, market liquidity and grid demands. The challenge lies in efficiently allocating ESS capacity to the most profitable markets. This paper addresses this challenge by developing an algorithm that combines predictive analytics, optimization techniques and real-time data processing to dynamically allocate ESS capacity across these markets.

The methodology proposed involves several steps, starting with data collection, where real-time market prices, RES forecasts and grid demand data are gathered. Predictive analytics, powered by machine learning (ML) models, generate forecasts of future market conditions. These predictions inform an optimization model that calculates the most profitable allocation of ESS resources, subject to constraints like ESS capacity, charge/discharge rates and market regulations. The optimization is formulated as a mixed-integer linear programming (MILP) problem, ensuring that the ESS operates within its technical limits while maximizing profit.

In addition to optimization, reinforcement learning (RL) is integrated into the algorithm to allow the ESS to continuously learn and adapt to market conditions. The RL framework ensures that the ESS respond to real-time fluctuations in market prices, grid demand and other variables, improving decision-making over time. By learning from its interactions with the market, the RL agent refines its strategy to achieve higher long-term profitability.

The concept of revenue stacking is also explored, where ESS operators participate in multiple markets simultaneously or sequentially, optimizing their operations to capture value across different market segments. This strategy enhances financial returns by using the flexibility of the ESS to provide services such as frequency regulation, voltage control and energy arbitrage.

This paper provides a comprehensive framework for ESS capacity allocation, using both traditional optimization techniques and advanced machine learning models. The proposed approach maximizes profits and also ensures that ESS are utilized efficiently, contributing to grid stability and RES integration.

2. Literature review

The integration of ESS into electricity markets has garnered significant attention in recent years, driven by the increasing penetration of RES. The literature surrounding ESS optimization primarily focuses on three key areas: energy market participation strategies, optimization techniques for capacity allocation, and the use of ML and RL for adaptive decision-making.

ESS have become critical in managing the intermittency of RES, such as wind and solar, by storing excess energy during periods of low demand and releasing it during high demand. Several studies have explored how ESS participate in various electricity markets to enhance profitability. In these markets, ESS operators may capitalize on price fluctuations and provide critical services like frequency regulation, voltage support and demand response. ESS engage in energy arbitrage in the DAM and IDM by charging during off-peak hours and discharging during peak demand, thereby exploiting price differences (Wu et al., 2022). However, the importance of accurate price forecasting in maximizing profits is expanded by subsequent research. Moreover, (Wang, Liu and Wen, 2024) explored the potential of ESS for providing ancillary services. The research emphasized that ESS generate higher revenues through such services compared to energy arbitrage alone, particularly when revenue stacking across multiple markets is permitted. The concept of optimizing ESS operations was also introduced to simultaneously participate in several market segments, a strategy that maximizes revenue but introduces complexity in the decision-making process.

Optimizing the allocation of ESS capacity across different markets has been a central focus of many studies, with several methodologies proposed. MILP has been widely used for formulating and solving the ESS scheduling problem. In their research, MILP models were further proposed for determining the optimal charging and discharging schedules for ESS in the DAM and BM, accounting for ESS constraints such as storage capacity, charge/discharge rates and efficiency losses (Muschick et al., 2022). In addition to linear programming methods, metaheuristic approaches like Particle Swarm Optimization (PSO) and Genetic Algorithms (GA) have been applied to solve the ESS optimization problem in complex, nonlinear market environments. (Kim et al., 2020) combined MILP with PSO for ESS capacity allocation in electricity markets. Also, (Li et al., 2023) combined MILP and PSO to provide an optimal schedule. PSO provides faster convergence and better adaptability in highly volatile market conditions. While MILP is highly effective for deterministic scenarios, PSO and other heuristic methods are better suited for environments with uncertainty and stochastic variables. Stochastic programming has also gained traction as a method to account for the inherent uncertainty in electricity markets, such as volatile prices and unpredictable RES output (Bhattacharya, Kharoufeh and Zeng, 2018).

As electricity markets become more dynamic, the integration of ML and RL into ESS management has been increasingly studied. ML models, particularly those based on time series forecasting, have been employed to predict market prices and grid demand with a high degree of accuracy. (Zhao, Zhang and Peng, 2022) illustrated the use of deep learning models, such as Long Short-Term Memory (LSTM) networks, to forecast power fluctuations caused by RES. Their results demonstrated the superiority of LSTM over traditional time series models.

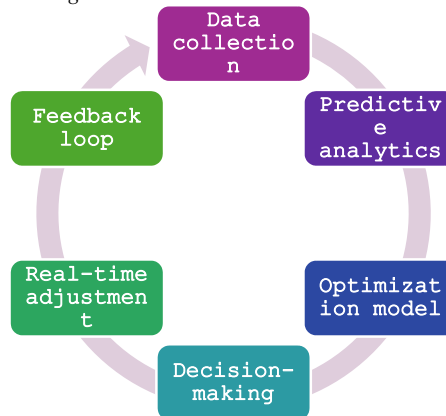
RL has emerged as a powerful tool for managing ESS. An RL-based framework was developed that controls ESS (Abedi, Yoon and Kwon, 2022). These models employed Q-learning to maximize profits while minimizing wear and tear on the ESS. Advanced RL techniques, such as Deep Q-Networks (DQN) and Proximal Policy Optimization (PPO), have also been applied to ESS management.

Recent research has also focused on hybrid models that combine ML, RL and traditional optimization methods. The hybrid approach may demonstrate superior performance in both profitability and adaptability compared to single-method models. Multi-objective optimization has become increasingly relevant as ESS operators seek to balance conflicting goals, such as maximizing profits and minimizing system degradation. (Song et al., 2023) developed a multi-objective optimization framework to optimize the charge/discharge schedule in each battery.

3. Research methodology

Developing an algorithm to allocate ESS capacity to various electricity markets to maximize profits involves creating a decision-making framework that dynamically adapts to changing market conditions and price signals. An outline of how such an algorithm might be structured, using predictive analytics, optimization techniques and real-time data processing is provided.

Figure no. 1. Steps of the proposed algorithm



Source: Authors' contribution

The algorithm starts by gathering real-time and historical data on electricity prices across different markets (DAM, IDM, ASM, BM), weather forecasts (to predict RES supply fluctuations) and grid demand forecasts. Using historical data, the algorithm employs ML models to forecast future price trends and demand patterns in each market. Techniques like time series analysis, regression models, or more complex neural networks can be used. The core of the algorithm is an optimization model that calculates the most profitable allocation of ESS capacity across different markets. This model considers: price forecasts obtaining predicted prices in each market; storage constraints such as ESS capacity, charge/discharge rates and efficiency; risk preferences settings that allow the operator to manage risk versus return preferences. The optimization model uses a MILP to determine the optimal schedule for charging and discharging operations. The goal is to maximize profit while adhering to operational and regulatory constraints. The algorithm adjusts its operations based on real-time market data and unexpected changes in the grid (e.g., outages, sudden demand spikes). This involves recalculating the optimization problem to reflect new conditions and potentially shifting storage resources to more profitable or necessary uses. The outcomes of the algorithm's decisions are continuously monitored and the results are fed back into the system to refine the predictive models and optimization framework, improving accuracy and profitability over time.

Pseudocode no. 1. Implementation

```
def optimize_ESS_allocation(prices, demand, capacity, charge_rate, discharge_rate):
    # Initialize optimization model
    model = OptimizationModel()
    # Define constraints
    model.add_constraint('capacity_limits', capacity)
    model.add_constraint('charge_limits', charge_rate)
    model.add_constraint('discharge_limits', discharge_rate)
    # Set objective to maximize profits
    model.set_objective('maximize', prices x (discharge_rate - charge_rate))
    # Solve the model
    optimal_schedule = model.solve()
    return optimal_schedule
# Run the algorithm every hour to update the ESS schedule
while True:
    current_prices = fetch_market_prices()
    current_demand = fetch_grid_demand()
    optimal_schedule = optimize_ESS_allocation(current_prices, current_demand, ESS_capacity, max_charge,
max_discharge)
    execute_schedule(optimal_schedule)
# Wait an hour before recalculating
wait(1 hour)
```

Source: Authors' contribution

RL is a type of ML where an agent learns to make decisions by interacting with an environment. In the context of ESS, the "agent" is the algorithm that manages the ESS and the "environment" includes the various electricity markets, price signals, grid demands and regulatory constraints. The goal of the agent is to maximize a reward function, which in this case is the profits from buying and selling energy at optimal times. The agent receives feedback in the form of rewards or penalties based on the actions it takes (e.g., charging or discharging the ESS at certain times), which it uses to improve its decision-making process. RL algorithms adapt to changes in market conditions without needing reprogramming or human intervention. This is essential in electricity markets where price signals and grid requirements can change rapidly. RL manages multiple objectives simultaneously, such as maximizing profits while minimizing wear and tear on the ESS. RL develops a strategy, that dictates the best action to take in a given market scenario. RL incorporates forecasts (like price, demand and RES supply) into its decision-making process, allowing it to make strategic decisions that account for expected future conditions.

In an RL model for ESS, the state includes all relevant information about the current market conditions, state of the ESS (e.g., current charge level) and any other pertinent information like weather forecasts. Actions are the possible decisions the agent makes at any time, such as how much power to charge or discharge and when to engage in each electricity market. The reward function is related to profit to ensure that the RL agent's goals align with the business objectives. The RL agent uses historical data and ongoing experience to develop and refine its policy for market participation. Over time, it identifies the best actions (strategies) to take in various situations to maximize cumulative rewards. To construct a mathematical model for maximizing profit from the allocation of storage capacity across various electricity markets, a range of variables are considered, including prices, capacity, charge and discharge rates and time constraints. Let us consider the following variables:

C_t = charge amount (in MWh) at time t
 D_t = discharge amount (in MWh) at time t
 S_t = state of charge of the ESS at time t
 P_t^b = price of buying electricity at time t
 P_t^s = price of selling electricity at time t
 η_c = charging efficiency of the ESS
 η_d = discharging efficiency of the ESS
CAP = total ESS capacity (in MWh)

r_c = maximum charging rate (in MW)

r_d = maximum discharging rate (in MW)

The objective is to maximize total profit, which is the revenue from selling electricity minus the cost of buying electricity, integrated over the operational horizon T :

$$\text{Maximize } \sum_{t=1}^T (P_t^s \times D_t - P_t^b \times C_t) \quad (1)$$

The main constraints are:

(1) ESS capacity constraints:

$$0 \leq S_t \leq CAP \quad (2)$$

(2) State of charge dynamics:

$$S_{t+1} = S_t + \eta_c \times C_t - \eta_d \times D_t \quad (3)$$

(3) Charging and discharging rate constraints:

$$0 \leq C_t \leq r_c \text{ and } 0 \leq D_t \leq r_d \quad (4)$$

(4) Non-simultaneous charging and discharging:

$$C_t \times D_t = 0 \quad (5)$$

Initial and final state of charge: S_1 is given and S_{T+1} may be set to a specific value or left free. The time increment t can be chosen based on the market intervals, typically hourly for many markets. Charging and discharging efficiencies (η_c , η_d) reflect energy losses during these processes. Prices (P_t^s, P_t^b) require estimation.

Enhancing the mathematical model for ESS capacity allocation with RL involves incorporating an RL algorithm to dynamically adapt the ESS operation based on learned strategies from market interactions. In an RL framework, the objective is to learn a strategy π that dictates the optimal actions to take in various states of the environment to maximize cumulative future rewards (profits in this case). This is achieved through interactions with the environment, which in this context consists of the electricity markets and ESS dynamics. Reward function R is defined as the profit from selling electricity minus the cost of buying electricity.

RL algorithm starts with a random strategy π or a baseline strategy for initializing C_t , D_t . At each time step t , observe the current state which includes S_t, P_t^s, P_t^b . Based on the strategy, RL agent determines the action a_t (either C_t or D_t , ensuring that charging and discharging do not occur simultaneously). Then, it calculates the immediate reward R_t from the action taken and the reward and the new state are used to update the policy using an RL method like Q-learning, Deep Q-Networks (DQN) or Proximal Policy Optimization (PPO), depending on the complexity and requirements. This process is continued, refining the strategy over time to maximize the expected cumulative reward.

Stacking revenue streams from various electricity markets is a strategy for investors using ESS as a flexible tool. This approach involves participating in multiple market segments simultaneously or sequentially, maximizing the financial returns from the ESS's operational capabilities. Thus, an ESS might be able to provide ancillary services while also engaging in arbitrage between the day-ahead and intra-day markets. For instance, an ESS could be contracted for frequency regulation while still retaining some capacity for charging and discharging based on price signals from the DAM and IDM. In markets where simultaneous participation is not allowed or feasible, ESS can shift between markets based on seasonal, weekly or daily variations in market conditions. For example, during periods of high RES output, an ESS might focus on energy arbitrage due to significant price volatility, while in periods of grid stress, it might prioritize ancillary services.

The revenue stacking strategy involves scheduling ESS operations to take advantage of the economic opportunities in these markets, sometimes participating in multiple markets within the same operational timeframe. It consists of (a) identifying overlapping opportunities where participation in one market does not preclude or undermine opportunities in another; (b) optimizing charging and discharging cycles to maximize revenue across different markets. For example, charge the ESS during off-peak hours using low-cost energy from the DAM and use the stored energy to provide frequency regulation in the ASM during peak hours; (c) monitoring real-time market signals and adjust operations dynamically. If prices spike unexpectedly in the real-time market, it might be more profitable to sell energy there rather than providing ancillary services; (d) optimizing for net metering and other incentives that might be available for using ESS to store and dispatch RES.

For instance, an ESS starts the day by charging during early morning hours when wind energy production is high, but demand is low, taking advantage of cheap electricity prices in the wholesale market. During the morning peak hours, it switches to providing frequency regulation services, earning premium payments. In the afternoon, it discharges to meet spikes in local demand, selling power at higher prices in the real-time market. Later, it may participate in the capacity market, ensuring availability during the highest demand periods of the day. Diversification across multiple revenue streams reduces financial risk as each market presents unique risks that may affect the profitability and operational strategy of ESS investments. A closer look at the risks associated with different markets and how these can be integrated into a mathematical model reveals that prices may fluctuate significantly due to unexpected changes in demand or supply conditions on DAM. Moreover, misestimations of DAM prices may also lead to suboptimal charge/discharge decisions. IDM are generally less liquid than DAM, which makes it more difficult to execute large trades without affecting prices. Prices may be more volatile within the day, impacted by real-time variations in demand and supply. Participating in ASM might lock the ESS into certain operational modes that preclude other potentially profitable activities. ESS might be reserved for peak demand periods, potentially underutilizing their capabilities at other times. On the other hand, high demands on ESS responsiveness and cycling may increase wear and tear on BM. Balancing responsibilities and compensation can vary, affecting predictability of returns.

To factor these risks into a mathematical model, we use a risk-adjusted return approach that modifies expected revenue based on the risk profile of each market using the following variables: P_t^m probability of successful trading in market m at time t ; R_t^m potential revenue from market m at time t ; γ_m risk adjustment factor for market m , reflecting the unique risks of each market. We modify the objective function to incorporate these risks by adjusting the expected revenue using a risk factor that penalizes or rewards based on the risk characteristics of each market:

$$\text{Maximize } E \left[\sum_{m \in M} \sum_{t=1}^T (P_t^m \times R_t^m \times \gamma_m) \right] \quad (6)$$

Where M is the set of all markets. The risk adjustment factor γ_m decreases the contribution of higher-risk markets to the objective function, thereby incentivizing safer, more predictable operations. Next, we add constraints that ensure compliance with operational and regulatory requirements for each market:

$$\sum_{t=1}^T (P_t^m) \geq \text{Min threshold of probability}, \forall m \in M \quad (7)$$

Then, we define γ_m based on historical data and predictive modelling of market risks. For example: DAM and IDM might have lower γ values during periods of high price volatility, whereas ASM might have higher γ values during stable regulatory periods.

4. Findings

Average prices in electricity markets can vary significantly depending on a variety of factors including geographic location, time of day, season, market demand, supply conditions and the penetration of RES. In the DAM, electricity prices are determined one day before the actual delivery. Prices in these markets vary widely based on anticipated demand and supply conditions for the next day. Generally, prices might range from \$20 to \$60 per MWh, but during periods of high demand or supply shortages, prices can spike much higher, sometimes exceeding \$100 per MWh. IDM allow for trading electricity on the same day of delivery, providing a mechanism to adjust positions taken in the DAM. These markets are typically more volatile. Similar to the DAM but can exhibit greater fluctuations. Prices might briefly peak at even higher rates during unexpected supply shortfalls or sudden demand spikes. ASM involves services that support the transmission of electricity from generators to consumers and help maintain grid reliability. Services include frequency regulation, voltage control and spinning reserve. The pricing is often premium due to the necessity and urgency of these services. Prices can be significantly higher than energy-only markets, sometimes several times the average DAM price depending on the urgency and the scarcity of available resources. Capacity markets are designed to ensure that there is enough power supply available to meet peak

demand. Participants are paid simply for being available to supply power, regardless of whether they actually generate electricity. Average payments range from \$5,000 to \$75,000 per MW per year, varying greatly by region and the reliability requirements of the grid (<https://www.energy-storage.news/evolution-of-business-models-for-energy-storage-systems-in-europe/>). BM manage the real-time variability in electricity supply and demand, ensuring that the grid remains stable. Prices in the BM can be highly variable. They range from negative values (when there is excess supply) to several times the average DAM rate during times of tight supply.

Estimating the potential annual revenue for an investor with a 10 MW installed ESS capacity requires some assumptions and calculations to provide an approximate estimate for different market scenarios. We assume its participation in DAM, IDM, ASM and capacity markets, and the following prices: for DAM, average price of \$40/MWh; for IDM, average price similar to DAM but with higher volatility; for ASM, premium services might offer prices ranging from \$50 to \$300/MWh depending on the service and urgency; and for capacity market, an average payment of \$20,000/MW per year.

We model the annual revenue from each type of market participation based on typical market operation scenarios: DAM and IDM-assume an average operational strategy where the ESS charges and discharges once per day (full cycle), with average price \$40/MWh for buying or selling, energy cycled daily 10 MW x 1 cycle/day = 10 MWh/day. Let's assume 250 effective operational days/year (accounting for lower price days and maintenance), the revenue is 10 MWh/day x \$40/MWh x 250 days = \$100,000/year.

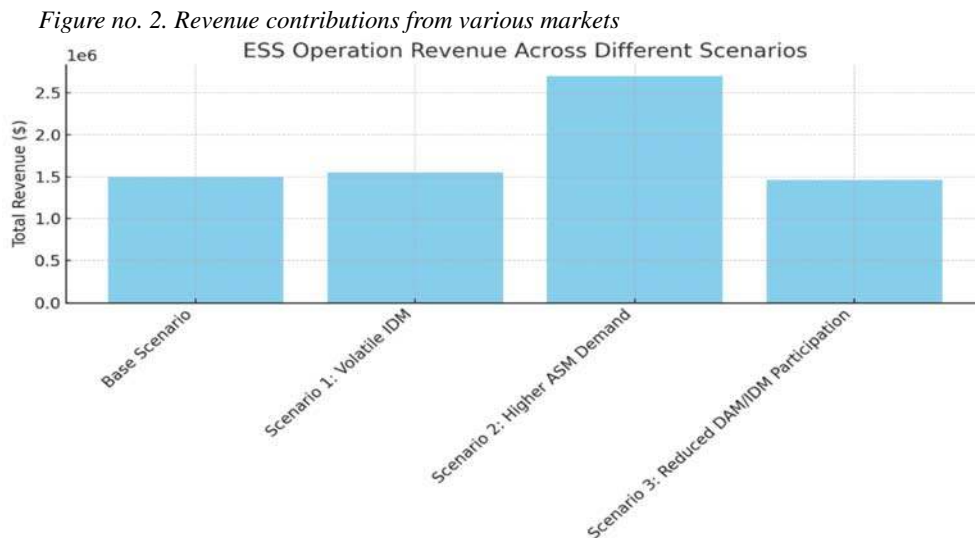
For ASM, assume participation in frequency regulation, priced higher due to its necessity, average price \$100/MWh (conservative estimate for premium services), daily participation: Assume 4 hours of service per day at full capacity, effective days 300 days/year (high demand for grid stability services), the revenue is 10 MW x \$100/MWh x 4 hours/day x 300 days = \$1,200,000/year.

For capacity market, the annual payment rate: \$20,000/MW and the revenue is 10 MW x \$20,000/MW = \$200,000/year. Total estimated annual revenue is from DAM and IDM (\$100,000) + ASM (\$1,200,000) + Capacity Market (\$200,000). The total is \$1,500,000/year. These costs need to be subtracted from the gross revenue to obtain net profits.

Three alternative scenarios are envisioned for a 10 MW ESS operation:

1. Scenario 1. Volatile IDM-Higher prices in the IDM lead to increased revenue from the DAM & IDM market.
2. Scenario 2. Higher ASM demand-A significant increase in ASM prices results in the highest total revenue.
3. Scenario 3. Reduced DAM/IDM participation-Reduced effective operational days for DAM & IDM lead to lower revenue from those markets.

Figure 2 breaks down the revenue contributions from DAM & IDM, ASM and the capacity market.



Source: Authors' contribution

Table 1 summarizes the revenue from different markets under each scenario, along with the assumptions driving those changes.

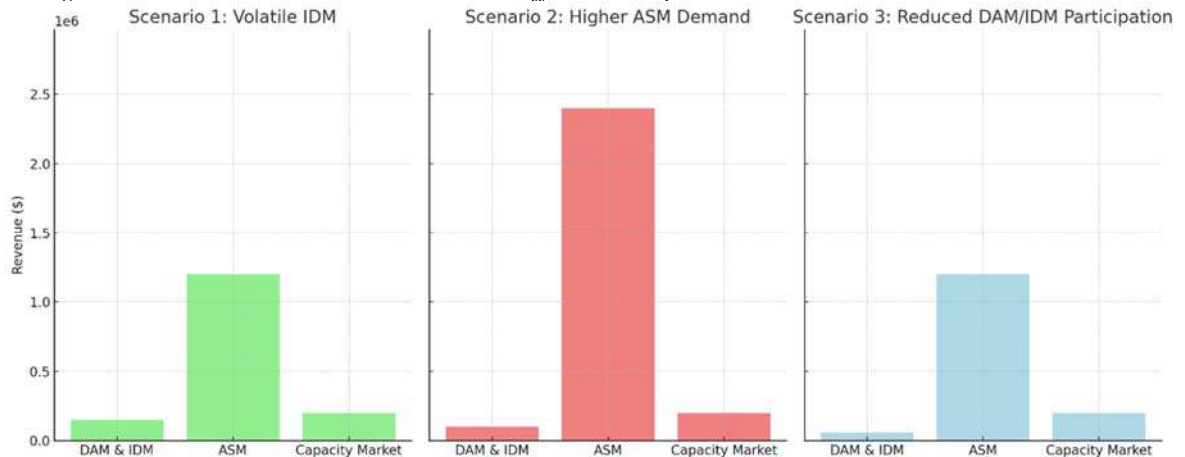
Table no. 1 Assumptions for each scenario and revenues

Scenario	Assumptions	Revenue from DAM & IDM (\$)	Revenue from ASM (\$)	Revenue from Capacity Market (\$)	Total Revenue (\$)
Base Scenario	<ul style="list-style-type: none"> - ESS Capacity: 10 MW - DAM & IDM Price: \$40/MWh - 250 Operational Days for DAM/IDM - ASM Price: \$100/MWh - ASM Participation: 4 hours/day, 300 days/year - Capacity market payment: \$20,000/MW/year 	100,000	1,200,000	200,000	1,500,000
Scenario 1. Volatile IDM	<ul style="list-style-type: none"> - IDM price increases to \$60/MWh - All other assumptions remain the same 	150,000	1,200,000	200,000	1,550,000
Scenario 2. Higher ASM demand	<ul style="list-style-type: none"> - ASM price increases to \$200/MWh - All other assumptions remain the same 	100,000	2,400,000	200,000	2,700,000
Scenario 3. Reduced DAM/IDM participation	<ul style="list-style-type: none"> - Only 150 operational days for DAM/IDM - All other assumptions remain the same 	60,000	1,200,000	200,000	1,460,000

Source: Authors' contribution

A comparison of potential annual revenues across different ESS operational scenarios is provided in Figure 3.

Figure no. 3. Potential annual revenues across different ESS operational scenarios



Source: Authors' contribution

5. Conclusions

The analysis of alternative scenarios for energy storage system (ESS) operation provides several important insights. First, it is clear that revenue diversification significantly enhances the profitability of ESS operations. The ability to participate in multiple markets, including the DAM, IDM, ASM and the capacity market, offers strong financial advantages. This diversification buffers against market fluctuations and ensures a more consistent stream of income, even under varying conditions such as volatile IDM prices or reduced DAM/IDM participation. In the scenario where IDM prices increase due to market volatility, the total revenue sees a modest increase. This demonstrates that price fluctuations in the IDM may positively affect revenues, particularly if the ESS capitalize on the volatility by adjusting its operations. However, while beneficial, the impact of volatile IDM prices on total revenue is relatively modest when compared to the changes observed in ASM conditions.

The analysis further shows that higher prices in the ASM have a profound effect on total revenue. When ASM prices increase, the total revenue jumps significantly, illustrating that ancillary services play a crucial role in revenue generation. ASM-related services such as frequency regulation can provide much higher returns than traditional energy arbitrage in DAM or IDM. Thus, ESS operators should prioritize participation in ancillary services to maximize profitability.

On the other hand, when DAM/IDM participation is reduced due to fewer operational days, the total revenue declines. However, ASM and capacity market revenues help to stabilize overall earnings. Across all scenarios, ASM consistently generates the highest revenue compared to DAM/IDM and the capacity market. Even in the base scenario, the contribution from ASM dominates, highlighting its importance as a revenue driver for ESS operators. The capacity market, while offering lower returns compared to ASM, provides stable and predictable income. This revenue stream helps cover fixed costs and serves as a hedge against the volatility of other markets. In conclusion, stacking revenue streams from multiple markets and adopting flexible, dynamic strategies are important for maximizing financial returns.

6. Acknowledgement

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Analysis of the Labor Market in the Current Socio-Economic Context of Romania

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Abstract

In this research, the proposed goal is to highlight the current state of the labor market generated by the current socio-economic context. The main objectives of this research are to highlight the main gaps recorded on the labor market in Romania, through the analysis of statistical data for the eight geographical regions. The research analyzes statistical data reported at the level of the first quarter of 2024, grouped by the total employed population in each analyzed region, the unemployment rate, as well as the distribution of the employed population on the main sectors of activity analyzed, but also an analysis showing the fluctuations recorded in the period 2020 - 2023 for people aged between 20 and 64, as well as highlighting the main branches of activity and of the main employers analyzed for each geographic region.

Key words: labor market, unemployment, active population, inflation, sustainability

J.E.L. classification: A11, O40, C50, F63

1. Introduction

Given the context of the COVID-19 pandemic, but also due to the events between Russia and Ukraine, to which are also added the effects of the energy and raw material crises, as well as the inflation index which registered very high rates, all these have reflected on the labor market, thus many companies registering a decrease in revenues, being forced to restrict activity and resort to the measure of technical unemployment. One measure was the Kurzarbeit program, which consists of launching a financing scheme for employees who have had reduced working hours. According to the statistical data resulting from the 2021 Population and Housing Census, it appears that 19.05 million people are registered on the territory of the country. The statistical data also show that 7.6 million people represent the civilian employed population, of which 5.5 million people are employees, approximately 59.21%. The distribution of the 59.21% of people engaged in the labor market, the distribution by the main fields of activity is as follows: the service sector, 63.63%, the share of employees in industry and construction is 33.63% in agriculture, forestry and fish farming approximately 1.81%.

After 2022, the Romanian economy registered a slowdown followed by an acceleration that was supported by investments, thus the real GDP growth in 2023 and 2024 is 2% as a consequence of the high inflation index, but also due to a context legislation at European level. Economic growth is supported in the medium term by the construction sector, investments, but also on the basis of income from European funds.

The unemployment rate in Romania according to the International Labor Office was 5.2% in the first quarter of 2024, while according to ANOFM, in the first quarter of 2024 the registered unemployment rate was 3.0%.

2. Theoretical background

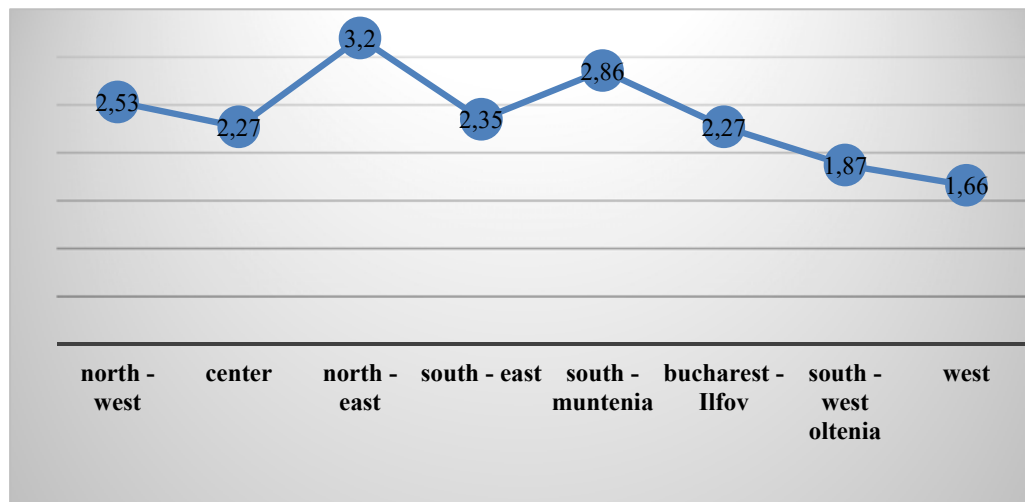
Labor market and workforce analysis by geographic region

From an administrative point of view, the labor market in Romania is structured into eight regions, as follows:

1. The North-West region comprising the following cities: Bihor, Bistrița Năsăud, Cluj, Maramureș, Satu Mare, Sălaj;
2. The Central Region comprising the following cities: Alba, Brașov, Covasna, Harghita, Mureș, Sibiu;
3. The North-East region comprising the following cities: Bacău, Botoșani, Iași, Neamț, Suceava and Vaslui;
4. The South-East region comprising the following cities: Brăila, Buzău, Constanța, Galați, Tulcea Vrancea;
5. South Region - Muntenia, comprising the following cities: Argeș, Călărași, Dâmbovița, Giurgiu, Ialomița, Prahova, Teleorman;
6. Bucharest - Ilfov region;
7. The South-West Oltenia Region, comprising the following cities: Dolj, Gorj, Mehedinți, Olt, Vâlcea;
8. The West Region comprising the following cities: Arad, Caraș Severin, Hunedoara, Timiș.

Figure 1 shows the number of the active population distributed over the eight geographical areas

Figure no. 1 Active population, first quarter – 2024 (millions)



Source: INS, author's processing

3. Research methodology

The main research methods that were the basis of this research are:

1. The analysis method based on the identification of some statistical data regarding the resident population of the eight geographical regions under discussion, as well as the employed population through the analysis of the main employers currently existing with reference to the main sectors of activity prevailing in each geographical region analyzed, last but not least, the unemployment rate is also analyzed, including the age gap of the employed population between 20 and 64 years old.

2. Another method addressed in this research aims at processing statistical data in the first quarter of 2024, highlighting the share of the employed population aged between 20 and 64 in the main sectors of activity such as: agriculture, forestry and fishing, services such as and industry and construction. The highlighting using the processing of some statistical data of the share of employment in the period 2020 - 2023, which highlighted that in our country there was an increase in the degree of employment from one year to another.

North-West comprising the following cities: (Bihor, Bistrița Năsăud, Cluj, Maramureș, Satu Mare, Sălaj), with a resident population in the first quarter of 2024 of 2.53 million people, the civilian employed population being 1.04 thousand people, which represents approximately 65.4% of the total human resource of the region. The unemployment rate recorded in the first quarter of 2024 was 2.1%, approximately 24.1 thousand unemployed.

The distribution of the employed population in the West region by main economic activities is as follows: agriculture, forestry and fishing 10.4%, services registering 51.2%, while industry and construction register 38.4%.

The North-West region stands out for the presence of almost all industrial branches, the peculiarity of the region being the concentration of most IT companies.

Among the main employers of the North-West region are: Banca Transilvania SA, Distribuție Energie Electrica, SC Aramis Invest SRL, Babes Bolyai Cluj University, County Hospital, DeLonghi Romania, SC Zollner Electronics SRL.

Center, (Alba, Brașov, Covasna, Harghita, Mureș, Sibiu), with a resident population in the first quarter of 2024 of 2.27 million people, the civilian employed population being 963.8 thousand people, which represents approximately 66, 4% of the total human resources of the region. The unemployment rate recorded in the first quarter of 2024 is 3.1%, approximately 30.6 thousand unemployed.

The distribution of the employed population in the Center region by main economic activities is as follows: agriculture, forestry and fishing 2.6%, services registering 57.6%, while industry and construction register 39.8%.

The central region stands out for its highly developed industry, especially in Brașov and Sibiu, thus the following industries are found: automotive, metal processing, food industry, wood processing, light industry, the IT sector, tourism having an extremely important role.

The main employers of the Center region are: SC Autoliv Roania SRL, SNGN Romgaz SA, Delgaz Grid SA, Selgros Cash&carry SRL, Spitalul Județean, Transgaz SA, Continental Automotive Systems, SC Preh Romania SRL.

North-East, (Bacău, Botoșani, Iași, Neamț, Suceava and Vaslui), being considered the largest development region in terms of population, this being 3.2 million inhabitants in the first quarter of 2024, thus 974.1 thousand, approximately 49.7% of the resource being employed population, while approximately 44.12 thousand, 4.28% being registered as unemployed, but also of the owned surface. The distribution of the employed population in the North-East region by main economic activities is as follows: agriculture, forestry and fishing 16.9%, services registering 51.7% while industry and constructions register 31.4%.

According to the number of employees, the main employers in the North-East area are: Dedeman, the Emergency County Hospital in Iasi, Amazon Development Center, Alexandru Ioan Cuza University in Iasi, TRW Airbag Systems SRL, Agricola Internazionale, Aerostar SA Bacău, SC Industries Yield SRL Bacău.

South-East, (Brăila, Buzău, Constanța, Galați, Tulcea Vrancea), agriculture playing an essential role, ranking first in the country in terms of vineyard areas, while fishing and trade in fish products are traditional activities. In the first quarter of 2024, the resident population is 2.35 million people, while the civilian employed population is 835.9 thousand people, which represents approximately 56.8% of the total labor resources of the region. The unemployment rate being approximately 35 thousand unemployed, 4.1%.

The distribution of the employed population in the South-East region by main economic activities is as follows: agriculture, forestry and fishing 14.0%, services registering 52.4% while industry and constructions register 33.6%.

The South-East region benefits from a diversified industry, such as: metallurgy, petrochemicals, machine construction, construction materials, food industry, textiles, the naval sector. The main employers of the South-East region are: SC Liberty Galați SA, Constanta Emergency Hospital, SC Vard Tulcea SA, Arabesque SRL, Universitatea Dunărea de Jos Galați, Clinica Sante SRL Buzău, Polaris Holding SRL Constanta.

South - Muntenia, (Argeș, Călărași, Dâmbovița, Giurgiu, Ialomița, Prahova, Teleorman), with a resident population in the first quarter of 2024 of 2.86 million people, the civilian employed population being 946 thousand people, which represents approximately 53.7% of the total human

resource of the region. The unemployment rate recorded in the first quarter of 2024 is 3.8%, approximately 37.6 thousand unemployed. The region is notable for the developed communications network with the eight riparian countries due to the Danube river, natural resources and various raw materials, chemical, petrochemical, automotive, construction materials, metallurgy, furniture, textiles, agriculture occupying an important role.

The distribution of the employed population in the South - Muntenia region by main economic activities is as follows: agriculture, forestry and fishing 15.6%, services registering 47.8% while industry and constructions register 36.5%.

The main employers in the South - Muntenia region being: SC Automobile Dacia SA, SG Adient Automotive Romania, SC Lear Corporation Romania, Yazaki Romania SRL, Lidl, SC Arctic SA, Ploiești Emergency County Hospital.

Bucharest – Ilfov, (Ilfov and the Municipality of Bucharest), with a resident population in the first quarter of 2024 of 2.27 million people, the civilian employed population being 1.4 million people, which represents approximately 88.5% of the total resource people of the region. The unemployment rate recorded in the first quarter of 2024 was 0.9%, approximately 13.3 thousand unemployed. The region stood out for having the highest GDP per capita in the country.

The distribution of the employed population in the Bucharest - Ilfov region by main economic activities is as follows: agriculture, forestry and fishing 1.1%, services registering 73.2% while industry and constructions register 25.7%.

Most of the industrial branches can be found in the region, thus the Bucharest - Ilfov region representing the largest industrial agglomeration in the country.

The main employers of the region are: National Railway Company CFR SA, National Company Posta Română SA, Kaufland Romania, Regia Autonomă a Padurilor, SC Mega Image SRL, SNTFC CFR Călători, Societatea de Transport Bucharest, Carefour Romania SA, RCS SA, Auchan Romania SA.

South-West Oltenia, (Dolj, Gorj, Mehedinți, Olt, Vâlcea), with a resident population in the first quarter of 2024 of 1.87 million people, the civilian employed population being 567.5 thousand people, which represents approximately 55.6% of the total human resources of the region. The unemployment rate recorded in the first quarter of 2024 is 5.5%, approximately 38.9 thousand unemployed.

The distribution of the employed population in the South-West Oltenia region by main economic activities is as follows: agriculture, forestry and fishing 17.0%, services registering 48.4% while industry and constructions register 35.0%.

The South-West Oltenia region is distinguished by a large expanse of agricultural land, over 1 million hectares.

The significant industries of the South-West Oltenia region are: metallurgy with the largest producer of aluminum in Central and Eastern Europe, electrotechnics, energy, automobile, chemistry, food industry, light industry, shipbuilding industry.

The main employers being: Complexul Energetic Oltenia Sud, SC Pireli Tires Romania SRL, Craiova County Hospital, SC Alro SRL, SC Vel Pitar SA, University of Craiova.

West, (Arad, Caraș Severin, Hunedoara, Timiș), with a resident population in the first quarter of 2024 of 1.66 million people, the civilian employed population being 749.4 thousand people, which represents approximately 65.6% of the total human resource of the region. The unemployment rate recorded in the first quarter of 2024 is 1.5%, approximately 12.5 thousand unemployed.

The distribution of the employed population in the West region by main economic activities is as follows: agriculture, forestry and fishing 10.0%, services registering 52.6%, while industry and construction register 37.4%.

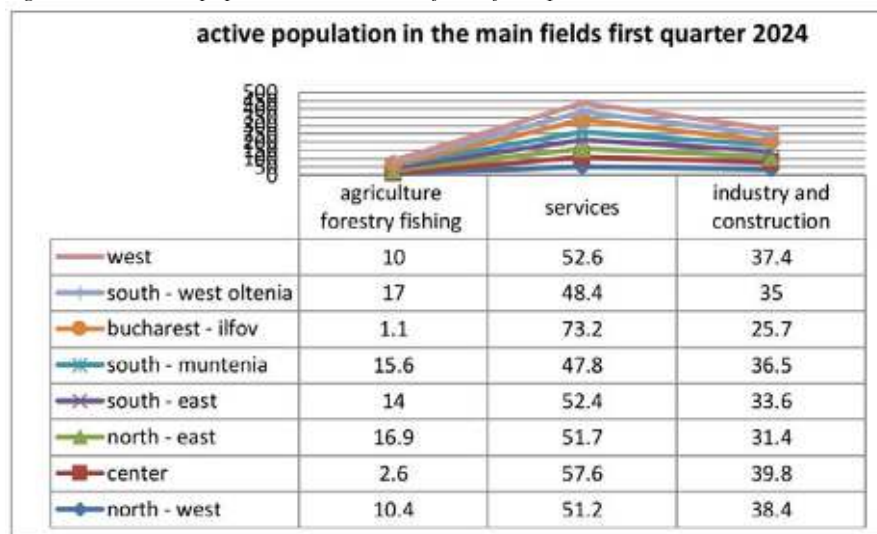
The West region is highlighted by an increased interest in investments from the European Union, especially for the agricultural sector.

The industry that can be found in the West region is: food, machinery and electrical equipment, means for rail transport of goods and passengers, furniture, clothing, footwear, iron and steel, metallurgy.

The main employers in the West region are: SG Profi Rom Food SRL, SC Continental Automotive Romania, SC Bordneze SRL, Timiș County Hospital, SC Leoni Wiring Systems Arad, Complexul Energetic Hunedoara.

From the analysis of the active population for the main categories of activity, reported in the first quarter of 2024, it follows that the highest share of employment in the field of agriculture, 16.9%, is recorded in the North-East region, and the lowest employment rate we can observe in the region in the Bucharest - Ilfov region with 1.1%. In the area of services, it can be noted that the highest share, 73.2%, is recorded in the Bucharest region, the lowest share being recorded in the South - Muntenia region, in the industry and construction area, we find that the most significant share is found in the Center region, and the lowest share in the Bucharest - Ilfov region.

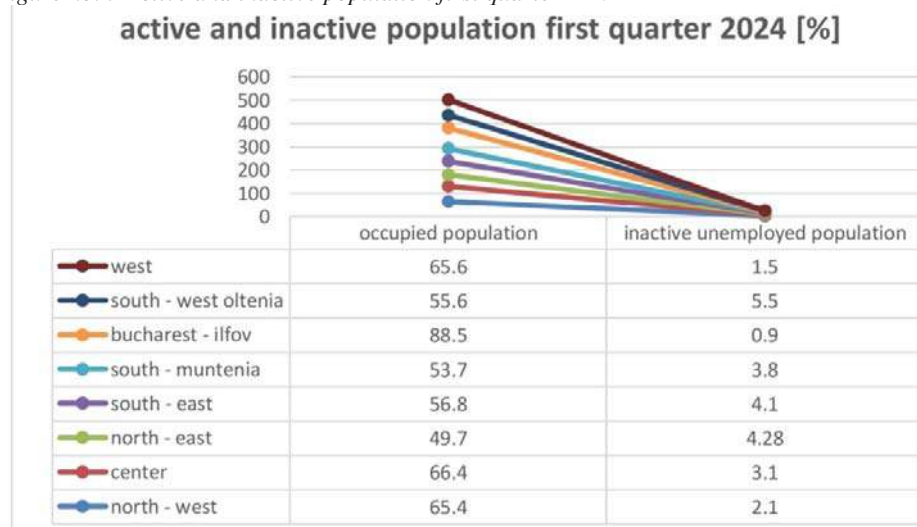
Figure no. 2 Active population in the main fields first quarter – 2024



Source: INS, author's processing

The analysis of the employment of the labor market in the eight geographical regions of Romania highlights the fact that the highest percentage is found in Bucharest - Ilfov, while the lowest percentage is found in the north-east region, and with regard to the unemployment rate, they meet 1.5 percentage points in the West region, this being the lowest unemployment rate in Romania reported in the first quarter of 2024, instead the highest unemployment rate note that was recorded in the south-west Oltenia region, reaching 5.5%.

Figure no. 3 Active and inactive population first quarter – 2024

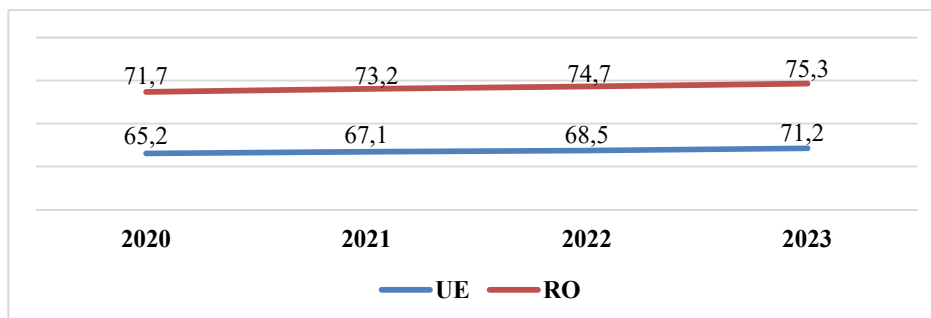


Source: INS, author's processing

4. Findings

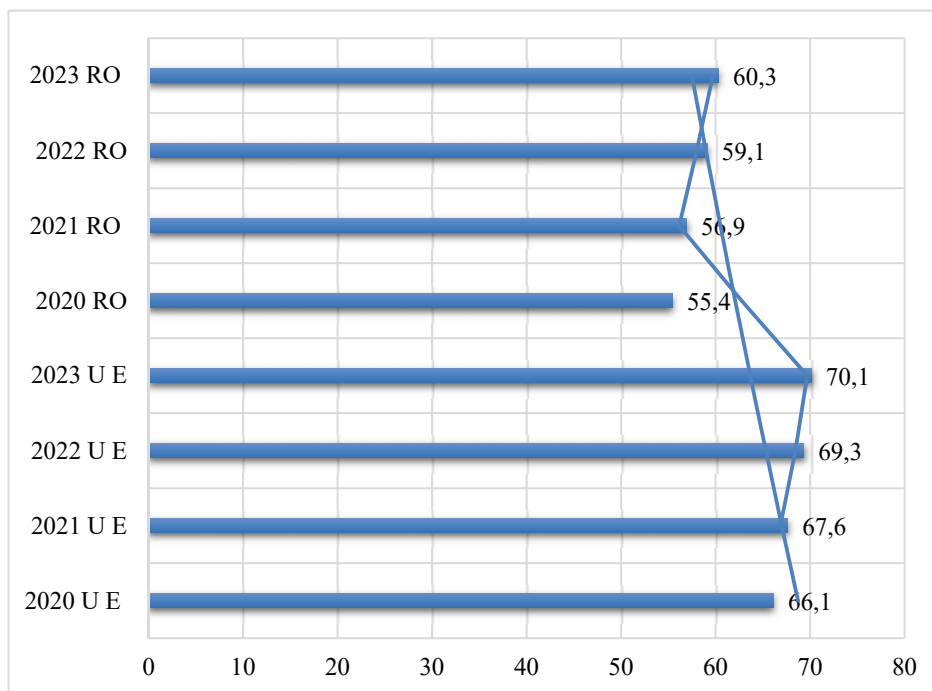
An analysis of the employment rate of the labor market for the age group between 20 and 64 years in the period 2020 - 2023, from which it follows that both in Romania and at the level of the European Union there has been an increasing trend, so we can see that in year 2023 in Romania there was an increase of 0.6% from 74.7% in 2022 to 75.3% in 2023.

Figure no. 4 Labor market employment rate between 2020 - 2023



Source: INS, author's processing

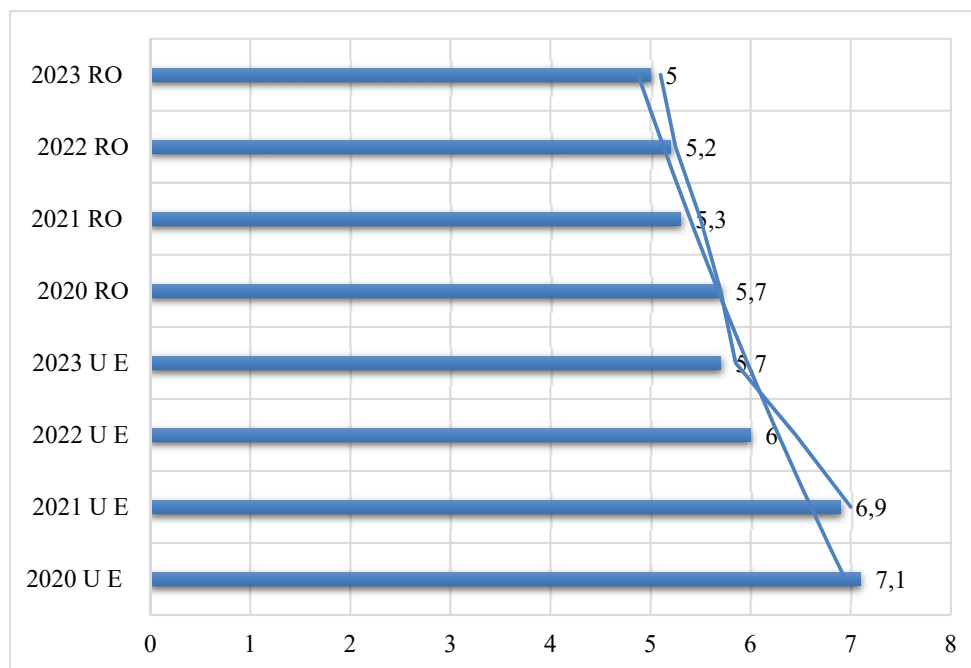
Figure no. 5 Occupation level of the female labor market, category 20 – 64 years



Source: INS, author's processing

Regarding the degree of employment of the labor market for women in the period 2020-2023 for the age gap 20-64 years, it follows that both at the level of the European Union and in Romania there have been percentage increases, thus in the year 2023 from 2022, the increase was 1.2% in the case of Romania, and at the level of the European Union the increase was 0.8% in the same period.

Figure no. 6 Unemployment rate category 20 – 64 years



Source: INS, author's processing

It can be seen that the unemployment rate had a decreasing trend in Romania as well as in the European Union, on the employed population aged between 20 and 64 years, thus we can see that in 2023 compared to 2022 the decrease in the unemployment rate recorded in Romania is of 0.2% while in the European Union the decrease was 0.3%.

5. Conclusions

From the analysis carried out, it is found that in 2022 there was a level of employment of 68.5% in the age group between 20 and 64 years, this situation was registered in a period in which there was a given the unemployment rate of 5.2%, below the European average.

In the current context, the labor market takes on a new concept, demand and supply, these being the main structures, are no longer summarized at the level of individuals but at the level of groups, economic and collective units with special personnel.

Currently we can talk about groups created specifically to defend the rights of the population employed on the labor market, these groups being the unions and employers, (the state).

The institutions that are directly related to the compliance with the legislative framework as well as the records of the employed population in the labor market must collaborate with each other with the aim of reducing the unemployment rate and the constant increase in the employment rate, exchange information and collaborate in the interest the community

There is an urgent need to develop a common vision of the development of the new generation of the workforce and the policy and application of the improvement of human resources. Governments and institutions at all levels must consider the major challenges of preparing workers for higher-paying, high-skilled jobs while helping those left behind by rapid economic change.

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Performance Management in Social Services: Practices and Challenges

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Abstract

The aim of the paper is to analyze the impact of performance management on the efficiency and professionalization of social work organizations, considering the specific challenges of this field. The study explores concepts such as goal setting, performance evaluation, feedback and recognition of merits, as well as new ethical and operational challenges.

The methodology combines questionnaires and semi-structured interviews with employees and managers to collect data on their perceptions and experiences related to performance management. The data analysis highlights the challenges and methods used to optimize management processes in social work organizations.

The conclusions emphasize the positive impact of performance management on organizational efficiency, emphasizing the importance of the balance between efficiency and ethical responsibility, and offer future research directions for the development of new evaluation methods adapted to the specifics of social interventions.

Key words: performance management, social assistance, feedback, personal development, transparency and accountability

J.E.L. classification: I38, M12, L31, M54, D73

1. Introduction

In today's context, within the social assistance sector, performance management represents a fundamental process to ensure the optimal use of resources—often limited both financially and especially in human terms—and to achieve organizational objectives aimed at supporting vulnerable communities. This process involves a systematic approach through which organizations align their resources and activities to maximize results (Armstrong et al., 2005, pp. 15-30). The authors highlight that effective performance management not only supports improved efficiency but also contributes to creating a work environment that encourages and motivates human resources.

In Romanian literature, the work "Managementul serviciilor de asistență socială" (Management of Social Assistance Services) by Neamțu (2015) emphasizes the importance of performance management in social assistance organizations, noting that it must also lead to a change in organizational culture. This is because social assistance work frequently exposes employees to complex emotional, social, and stress-related challenges that are sometimes difficult to manage.

Beyond improving the efficiency of activities, performance management can enhance transparency and accountability in organizations, where beneficiaries and civil society are increasingly interested in the quality and fairness of services provided. According to Pulakos in *Performance Management: A New Approach for Driving Business Results* (Pulakos, 2009, pp. 22-40), the performance evaluation process allows for a systematic approach to tracking employee progress and establishing clear performance expectations. In this way, a well-implemented system becomes an essential tool for ensuring service quality in the social sector.

The purpose of this research is to analyze how performance management in social assistance supports social development by increasing the efficiency and effectiveness of social services. It also examines the challenges of implementing performance management in a field often characterized by budget constraints and the difficulty of measuring progress in a quantifiable, objective manner. Social assistance organizations face growing pressure from civil society and other stakeholders to justify the efficient use of resources and deliver higher-quality services. In this context, implementing a performance management system is a strategy that can deliver concrete results. Aguinis, in *Performance Management* (Aguinis, 2009, pp. 45-55), argues that such a system not only supports organizations in achieving their mission but also contributes to the professional development of human resources, which is a key factor in reaching organizational goals.

Behn, in *Why Measure Performance? Different Purposes Require Different Measures* (Behn, 2003, pp. 586-606) underscores that performance measurement in the public sector, and implicitly in social assistance, requires a careful balance between objective and subjective criteria.

2. Theoretical background. The Concept of Performance Management in Social Assistance

The concept of performance management refers to a structured process of evaluating, monitoring, and continuously improving performance within an organization to maximize outcomes and achieve established objectives. Pulakos, in *Performance Management: A New Approach for Driving Business Results* (Pulakos, 2009, pp. 22-40), describes performance management as more than a periodic employee evaluation; it includes complex processes such as goal setting, providing constant feedback and supporting professional development. This approach fosters a paradigm shift in human resource management, focusing on long-term results and organizational commitment to continuous performance improvement.

In the context of social assistance, this approach takes on particular nuances, as organizations in this field work with vulnerable groups and often have missions aimed at supporting and developing the communities they serve. Thus, performance management in this sector is not only about economic or efficiency goals but also about ensuring quality and equity in service delivery. This requires a balance between objective evaluation and a personalized, empathetic approach that considers the complexity of cases managed by social assistance staff.

Performance management plays an important role in aligning organizational objectives with beneficiaries' needs, contributing to better resource allocation and increased efficiency in service delivery. Aguinis, in *Performance Management* (Aguinis, 2009, pp. 45-55), argues that an efficient performance management system can significantly enhance an organization's capacity to fulfill its mission and better meet the needs of the communities it serves. Aligning organizational objectives with beneficiaries' needs is not just a strategic direction but a necessity for improving the impact of social assistance services. The same author highlights the importance of integrating qualitative dimensions, such as the quality of interactions with beneficiaries and adherence to the organization's ethical values, alongside quantitative performance measurement.

For example, in social assistance, a relevant performance indicator might be not only the number of cases handled by an employee but also the quality of support provided, as measured by beneficiary feedback and qualitative evaluations of the interventions performed.

Under these circumstances, the role of performance management in social assistance extends beyond mere individual performance monitoring. It includes ensuring a work environment that promotes professionalism, empathy, and respect for beneficiaries. This can contribute to building an organizational culture based on responsibility and social benefit orientation, enabling social assistance organizations to better fulfill their mission and optimize their impact on the community.

Setting clear and measurable objectives is an essential element in performance management, enabling organizations to align employees' activities with the overall strategy. Neamțu, in *Managementul serviciilor de asistență socială* (Neamțu, 2015, p.45-60), emphasizes that in the social assistance sector, objectives must be customized to address both organizational needs and those of the beneficiaries.

Thus, alongside measurable results, such as the number of resolved cases, significant importance is given to qualitative aspects, such as the quality of interventions and relationships with beneficiaries. Neamțu proposes a participatory approach to setting objectives, where employees are actively involved to understand and support the organization's priorities.

Performance evaluation is the process through which employees' achievement of objectives is analyzed. Lazăr and colleagues, in *Perspective asupra sistemului și serviciilor de asistență socială din România* (Lazăr et al., 2020, p.78-95), explain that, in the context of social assistance, evaluations should include both quantitative indicators (e.g., number of managed cases) and qualitative ones (e.g., beneficiary satisfaction and adherence to ethical principles). The authors highlight that using a mix of objective and subjective indicators can lead to a more balanced and realistic evaluation, reflecting the complexity of social work.

It can be stated that an evaluation system, in order to be effective, must include constant feedback from the beneficiaries in order to obtain a more complete picture of the impact of the social activities provided on them. This highlights the fact that employees who receive positive feedback from beneficiaries become more motivated to continue efforts to improve the services offered.

In performance management, providing constant and constructive feedback is crucial. According to Neamțu (Neamțu, 2015, p.105-120), regular and development-oriented feedback is essential for the professional growth of social assistance employees, who often face complex and demanding social situations. Neamțu suggests that effective feedback must be personalized and provide clear directions for performance improvement.

Lazăr and his team (Lazăr et al., 2020, p.130-145) argue that a feedback-oriented organizational culture can significantly improve employee engagement and satisfaction. They recommend implementing regular feedback sessions to contribute to skills development and reduce professional stress levels.

Recognizing employees' merits is another key factor in creating a positive organizational culture. According to Lazăr and his team *Renasterea unei profesii, Sau despre cum este sa fii asistent social in Romania*, (Lazăr et al, 2016, p.95-110), recognizing employees' contributions can take various forms, from formal rewards such as prizes and bonuses to informal appreciation and advancement opportunities. It is emphasized that performance recognition not only improves employee morale, but also contributes to creating a work environment that encourages collaboration and loyalty to the organization.

Thus, in social assistance organizations, the evaluation of the performance of human resources must be adapted to the specifics of the work performed, so as to reward not only the volume of work performed, but also the quality of relationships and the positive impact on the community served.

In the social assistance sector, financial and human resources are often limited, and organizations frequently face budgetary constraints that hinder the implementation of an efficient performance management system. Hatry, in *Performance Measurement: Getting Results* (Hatry, 2006, pp. 25-38), analyzes the impact of limited resources on organizations' capacity to invest in complex performance management processes.

In public and nonprofit sectors, including social assistance, budgetary constraints often lead to compromises in setting and tracking performance objectives. Organizations are compelled to prioritize direct service provision over administrative processes. Hatry emphasizes that without investments in training, technology, and dedicated personnel, effective performance management implementation becomes difficult, which can affect an organization's ability to monitor and improve service quality.

Another major obstacle is the difficulty of objectively and quantitatively measuring results, given the complexity and subjective nature of social interactions. Behn, in *Why Measure Performance? Different Purposes Require Different Measures* (Behn, 2003, pp. 586-606) highlights that performance measurement in social domains is uniquely challenging because the objectives of these organizations cannot always be quantified.

For example, measuring success in social assistance cannot be reduced to the number of cases handled. It must also consider qualitative aspects such as the quality of relationships with beneficiaries and long-term improvements in individual situations. Behn argues that this need for complex and varied measurements makes performance management difficult to implement and sustain in social assistance organizations.

Organizational process changes, including the introduction of a new performance management system, often face employee resistance. Kotter, in *Leading Change* (Kotter, 1996, pp. 35-50), explains resistance to change as a natural reaction when employees encounter new demands and responsibilities. This resistance is even more pronounced in fields where daily activities are already challenging, as is the case in social assistance. According to Kotter, a key element to overcoming resistance is communicating the benefits of change and actively involving employees in the implementation process.

In social assistance, performance management systems may be perceived as an additional burden, especially if employees view the evaluation process as strictly procedural rather than a means of support and development. Kotter recommends that leaders adopt a transparent and participative approach to reduce resistance and facilitate the transition to new performance evaluation systems.

Performance evaluation in social assistance often raises ethical and moral dilemmas, as employees work with vulnerable individuals, and evaluation criteria may sometimes seem inadequate to measure the real success of interventions. Van Dooren, Bouckaert, and Halligan, in *Performance Management in the Public Sector* (Van Dooren et al., 2010, pp. 140-155), explore the complexity of ethical dilemmas in performance evaluation in the public sector. The authors emphasize that in fields such as social assistance, it is challenging to establish performance criteria that reflect both organizational results and ethical responsibility toward beneficiaries.

For instance, evaluating employees based on the number of resolved cases can pressure them to complete cases quickly, potentially at the expense of the quality of support provided to beneficiaries. Van Dooren, Bouckaert, and Halligan suggest that organizations should consider both performance objectives and ethical values in the evaluation process to ensure employees do not feel constrained to prioritize efficiency over the well-being of beneficiaries.

3. Research methodology

To achieve our objectives, we analyzed how performance management influences the efficiency and quality of services provided in the field of social assistance. The research focused on identifying current practices, challenges faced, and strategies to improve performance in organizations providing social services. A mixed-methods approach combining quantitative and qualitative methods was used, ensuring a comprehensive perspective on the subject.

Data Collection. The study utilized two primary data sources:

1. Questionnaires. Structured questionnaires were distributed to employees in various social assistance organizations to evaluate their perceptions of performance management, feedback, and performance recognition.
2. Semi-structured Interviews. In addition to questionnaires, 15 semi-structured interviews were conducted with managers in the field of social assistance. These interviews provided detailed insights into the challenges of implementing performance management and the strategies used to overcome these challenges. The interviews were recorded, transcribed, and thematically analyzed to identify patterns and trends.

Research Methods Used. A combination of quantitative and qualitative methods was used for data collection:

1. Quantitative Method. The questionnaires included both closed-ended questions (to measure perceptions quantitatively) and open-ended questions (to gather detailed and nuanced responses). The sample included 100 employees from diverse roles and organizations to provide a varied picture of existing practices.
2. Qualitative Method. The semi-structured interviews were analyzed thematically to identify recurring themes, such as measuring the performance of human resources involved, the importance of constructive feedback, and ethical challenges. Data coding was done manually to extract essential information about best practices and lessons learned.

Although the study provides valuable insights into performance management in social assistance, it has certain limitations due to the relatively small and specific sample size, which may limit the generalizability of the results to other social organizations. Additionally, qualitative data, while detailed, may be influenced by respondent subjectivity. However, ethical standards were strictly

observed during the study, ensuring confidentiality and anonymity for participants. The data collected was used exclusively for academic and research purposes.

4. Findings. Data Analysis and Interpretation of Research Results

a) Quantitative Analysis

Data from the questionnaires were analyzed to evaluate correlations between variables, such as feedback, performance recognition, and employee satisfaction levels. Descriptive and inferential analyses were conducted to identify general trends and test initial hypotheses.

Key findings from the structured questionnaires:

- Performance evaluation systems: 72% of respondents indicated that their organization uses a formal performance evaluation system, but only 58% felt that the system is clear and well understood by employees.
- Employee feedback: Approximately 65% of respondents stated they receive periodic feedback, yet only 45% considered the feedback useful for improving their activities. This suggests that while feedback is provided, it is not always perceived as constructive or applicable.
- Performance objectives: 60% of participants reported that performance objectives are established, but many highlighted difficulties in aligning these objectives with beneficiary needs.
- Performance recognition: Only 40% of employees felt that performance recognition in their organizations is adequate and motivating. Many respondents emphasized the lack of effective non-financial reward mechanisms.

b) Qualitative Analysis

The semi-structured interviews provided deeper insights into challenges and strategies for improving performance management:

- Challenges: Managers frequently mentioned the difficulty of objectively measuring performance given the complex and sensitive nature of social work. The lack of appropriate evaluation tools was cited as a demotivating factor for employees.
- Feedback importance: While organizations strive to provide constant feedback, it often lacks personalization and does not address employees' specific needs. Managers suggested training in feedback delivery to improve this process.
- Ethical considerations: Managers highlighted ethical dilemmas, where performance evaluations emphasizing measurable outcomes sometimes overlooked the quality of human relationships and empathy.

c) Correlations Identified

- Feedback and employee satisfaction: A moderate positive correlation ($r = 0.45$) was found between the frequency of feedback and employee satisfaction, indicating that employees receiving regular feedback tend to be more satisfied with their work.
- Clear objectives and performance: A positive correlation ($r = 0.53$) was observed between the clarity of set objectives and perceived performance levels, suggesting that employees with a clear understanding of objectives perform better.

d) Recommendations Based on Research Results

- Improving feedback systems: Organizations should invest in training managers to provide more specific and constructive feedback perceived as helpful by employees.
- Clarifying performance objectives: Establishing clear and realistic objectives aligned with beneficiary needs can improve performance and employee satisfaction.
- Recognizing and motivating employees: Developing both formal and informal recognition mechanisms could enhance staff motivation and reduce turnover in social assistance organizations.

e) Study Limitations

The study is limited by its small sample size and the specific nature of the organizations studied, which may restrict the generalizability of results to other contexts. Additionally, qualitative data may be influenced by participants' subjective perceptions, warranting caution in interpreting conclusions.

5. Solutions and Recommendations for Improving Performance Management in Social Assistance Services

In light of the challenges discussed, adopting appropriate strategies could improve the efficiency and sustainability of performance management in social assistance organizations. Mayne, in *Best Practices in Results-based Management* (Mayne, 2007, pp. 65-78), proposes strategies centered on results-based management that can also be applied in the social assistance sector. One of Mayne's key recommendations is involving employees in setting objectives and performance indicators through a participatory approach. This involvement motivates employees to achieve established objectives.

Mayne also emphasizes the importance of continuous monitoring and evaluation systems that provide real-time feedback on progress. In social assistance organizations, this strategy can help identify and quickly address deficiencies, allowing constant adaptation of approaches. For example, by regularly monitoring performance, managers can detect training needs for staff directly interacting with beneficiaries. Such continuous adjustments can optimize resources and address issues affecting service quality.

For effective performance management implementation, Aguinis, in *Performance Management* (Aguinis, 2009, pp. 210-225), and Armstrong and Baron, in *Performance Management: Key Strategies and Practical Guidelines* (Armstrong et al., 2005, pp. 210-225), offer practical recommendations applicable to social assistance. Aguinis suggests developing a performance management framework that integrates both periodic evaluations and support for continuous professional development. This can include mentorship and training programs to help employees develop the competencies necessary to meet the challenges of social assistance.

Adopting a holistic approach emphasizes not only achieving objectives but also the quality of relationships and beneficiary satisfaction. This approach involves integrating organizational values into the performance evaluation system, ensuring employees not only meet administrative requirements but also act in line with the organization's mission. Feedback methods should include beneficiary input to provide a complete picture of employee performance.

Developing a recognition and reward system tailored to the specificities of social assistance organizations is recommended. Recognition should not rely solely on financial rewards but also informal appreciation and opportunities for professional advancement. Such practices can boost staff motivation and reduce turnover, a common challenge in this sector.

Leadership must actively promote the importance of performance management by implementing these recommendations and supporting them. Clear communication of performance management objectives fosters an organizational environment where employees feel supported, valued, and appreciated. These recommendations support social assistance organizations in improving performance management and maximizing the positive impact of their activities on beneficiaries and the communities they serve.

6. Conclusions

Performance management can play a decisive role in improving the quality and efficiency of social assistance services. Implementing such a system provides the necessary framework for continuously evaluating and improving individual and organizational performance, leading to better adaptation to the needs of the community and beneficiaries. In a field marked by limited resources and the complexity of interventions, performance management aids in efficiently allocating resources and identifying areas requiring additional support or adjustments.

Performance management also enables constant monitoring and flexible adaptation of approaches, promoting greater accountability and transparency in service delivery. Emphasizing continuous employee development contributes to creating a work environment that encourages both performance and professional satisfaction. In a challenging field, this approach has the potential to reduce staff turnover, increase stability, and improve relationships with beneficiaries.

In conclusion, performance management is not just a tool for evaluation but also a resource for increasing professionalism and accountability in social services. Proper implementation can uphold the ethical values of the field, contributing to building organizations that prioritize both beneficiary well-being and professional development for staff.

Despite significant challenges such as limited resources, the difficulty of measuring results in social contexts, and resistance to change, the potential benefits of an efficient performance management system are substantial. These include improved service quality and transparency, enhanced accountability, employee professional development, and optimized resource utilization.

Future research should focus on identifying new solutions to enhance the sustainability and flexibility of performance management, effectively adapting it to the realities and specific needs of social assistance organizations.

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Data Management Competencies – A Need for Digital Age

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Abstract

Our lives are shaped by digital technology, which requires expansion to new capabilities and technologies that can support the speed of digital change and business trends.

Education is the main pillar to ensure the transition to the digital age, with data literacy leading society toward sustainable growth. Implementation strategy plays an important role in digital transformation, both in adapting to digital changes and integrating new educational plans based on solid methodological tools.

Data are becoming monetized business assets. Statista revealed that there will be just over 180zb of data produced by 2025 in the world, while Forbes shows that 95% of companies need to manage unstructured data.

The purpose of this research is to present data management and the core capabilities around this concept to prepare global citizens independent of their role in society to face the challenges that will affect the labor market.

Key words: Digitalization; Labour market; Data management; Data monetization

J.E.L. classification: I0; J2; O3

1. Introduction

In the context of current society state, according to Gartner studies, information is essential, but the most valuable input comes from the use of data. The data-driven culture reinforces continuous performance improvement to create customer care centric business providing another hint about data driven enterprise and usage of cutting-edge new technologies.

There is multiple reasoning in which data helps to improve the quality of people's lives, can help decision makers, can influence the usage of different strategies translated into increasing competitiveness on the market or all reasoning simultaneously. Thus, the concept of data management is developed, which represents the totality of the processes necessary to manage different activities throughout the cycle of development or substantiation of a decision. Even though the need to increase data competencies appears frequently in the private environment, the skills should be developed during schooling. The capabilities mirror each other in the need to teach learners about the form and format of data and databases, the management of that data, the curation and reuse of data, and the metadata used to describe that data(Qin and D'Ignazio, 2010; Carlson et al., 2011; Piorun et al., 2012; Prado and Marzal, 2013; Schneider, 2013; Coombs, Malinowski and Nurnberger, 2019). Overall, there is solid consensus in the literature of competencies regarding the major themes that should be addressed in data education.

Major players in the digital industry have invested in research studies, and the results lead to the benefit of developing the skills and competencies necessary for the analysis and informational exploitation of data.

2. Theoretical background

The digital age requires professionals to develop essential skills for effective data management and adaptation to an ever-evolving technological landscape. These are necessary for the effective management and use of data in various professional contexts, especially in response to the evolving demands of the digital landscape.

Skills such as data management, digital literacy, and adaptability to technological changes are fundamental to the success of professionals in the digital age. They allow the management of data complexity and effective use of digital tools, thus contributing to meeting the demands of a dynamic and constantly changing professional environment.

A strong data governance culture is vital to harnessing data-driven technologies. One example is the USDA-ARS partnerships that demonstrate the transformative impact of collaboration in data management for agricultural research (Harmel et al., 2021). At the same time, understanding the quality and limitations of big data is essential, given the risks of distortions due to digital divides, which requires meticulous analysis to avoid errors in data use (Baur et al., 2020; Büchner, Hergesell and Kallinikos, 2022).

When it comes to essential skills for effective data management and adaptation to the current technological context, digital literacy plays a central role in the efficient processing and use of information. Professionals must be able to operate using various digital tools and interact effectively with modern interfaces. These skills are recognized as essential for the future workforce, especially in higher education, where digital skills contribute to integration in complex technological environments (Mei, Feng and Cavallaro, 2023; Maulidevi et al., 2024).

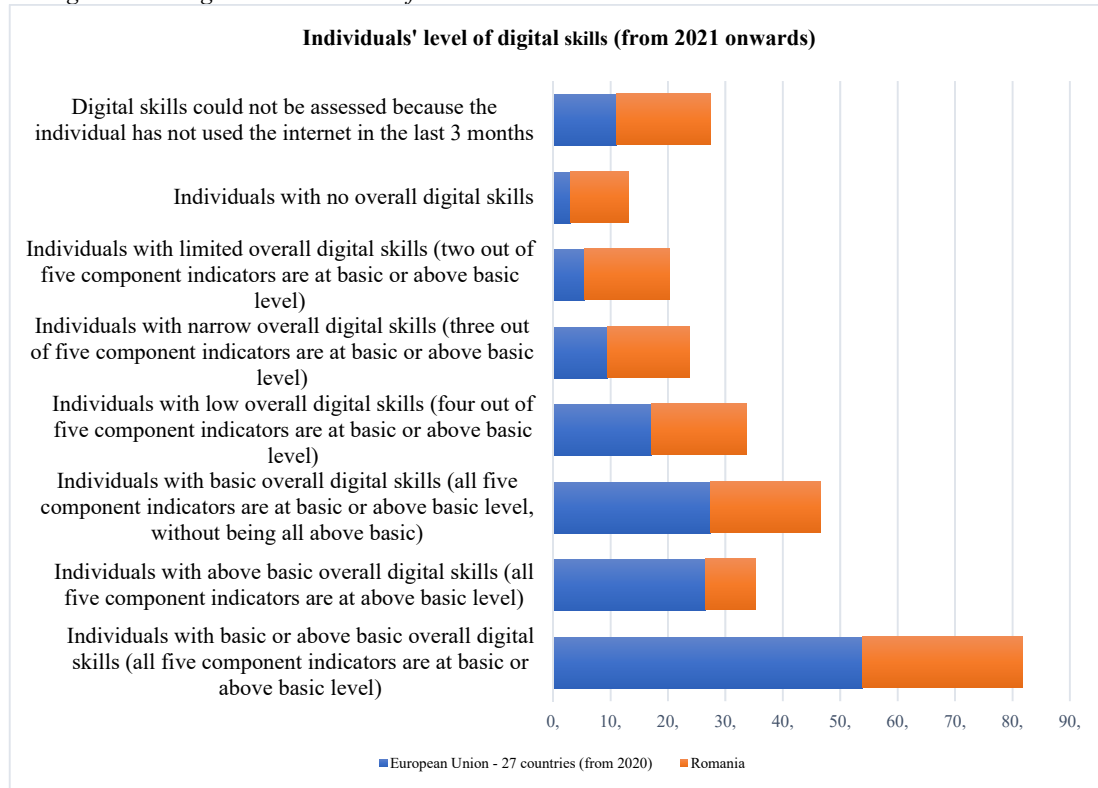
Conversely, adaptability to technological change is indispensable in the context of accelerated technological progress. Professionals in industries such as hospitality and tourism need to adjust their practices to integrate new digital tools and methodologies (Cheng et al., 2023). Similarly, in educational institutions, the adoption of emerging technologies is necessary to meet user requirements, reflecting a general need for flexibility in various professional fields (Nkuebe, 2017; Busulwa, Pickering and Mao, 2022; Mei, Feng and Cavallaro, 2023).

The impact of data management skills on professional effectiveness in digital environments is multifaceted, involving the need for organizations to embrace digital transformation, develop relevant skills, and recognize the importance of emotional intelligence. These elements are necessary to improve workforce capabilities and ensure success in an increasingly digital world (Jason, Hung and Ida, 2023; Akter et al., 2024).

These findings demonstrate that the advances in digital transformation and the demand for data management skills are not isolated phenomena but are closely linked to the accessibility and adoption of digital infrastructure at a societal level. Thus, as organizations improve their workforce capabilities, the broader context of the digital readiness of the population becomes increasingly important. In Romania, for example, the expansion of internet access has laid the foundation for the integration of digital skills into education and vocational training, creating opportunities to align individual skills with organizational needs. However, reducing the gap between infrastructure and skills development remains an urgent challenge, as seen in the discrepancies between the average number of Romanians and the European Union (EU) in terms of digital skills.

According to the data provided by Eurostat, in the period 2013-2022 there is a significant increase in Internet access in households in Romania, the 2019-2021 pandemic period being noted, where the level reached approximately the average of the EU. Thus, a favorable context is created for the digitization of education and digital skills in Romania. However, a low level of digital skills acquired by Romanians can be observed, compared to the average of the European Union.

Figure no. 1 Digital skills overview from 2021 onwards



Source: Eurostat

According to Statista, by 2025 the volume of data will reach approximately 180 ZB, while Gartner claims that more than 70% of companies will redirect their focus to the storage and analysis of large volumes of data. Also, an interesting aspect is captured by Forbes, according to which 95% of companies must adapt to the storage of unstructured data. To all these statistics is added the pandemic context generated by COVID-19 which has accelerated the digitization and use of data. With all this context, the role of Data Scientist or Data Engineer become one of the most sought-after and well-paid roles in the field of data.

3. Research methodology

This research was conducted using a qualitative methodology with the aim of exploring the impact of data management skills on professional performance in an ever-changing digital era. Thus, the literature review stage was the first step in identifying the essential dimensions of data management, such as governance, data quality, and data integrity (Wang and Strong, 1996; Black and van Nederpelt, 2020).

A key aspect of the study was the development of a competency matrix using the 360-degree feedback method to assess the level of data literacy within organizations. The approach was chosen to obtain a comprehensive and objective assessment of employee skills given that this type of feedback allows for the collection of information from multiple sources, including superiors, colleagues, and subordinates, which provides a holistic view of individual skills, thus resulting in a more complete and accurate assessment (Workhuman Editorial Team, 2024).

In the research, this tool was used to identify both strengths and areas that require development in terms of data management and use. Thus, the use of the competency matrix to assess data literacy skills enabled the identification of employee training levels in terms of data management and use, with the aim of improving their capabilities through specific training. An example of a similar approach is the research conducted by QlikTech International (2022), which showed that the majority of business decision-makers lack confidence in their data literacy skills, highlighting the need for

systematic and objective assessments of data skills at the organizational level. The matrix was validated through 360° feedback, providing a broader view of the current skills and the necessary development directions.

Another important aspect of this research is the analysis of the collaboration between higher education institutions and the private sector to meet labor market demands. The proposal to develop specialized educational programs that support the development of digital and data management skills, as already highlighted by Moldoveanu and Narayandas (2019), shows the importance of integrating them into university curricula to meet the demands of current industries. Based on this methodology, strategic recommendations were formulated to improve digital literacy and data management skills, proposing a more integrated and practice-oriented approach that would allow organizations to quickly adapt to new technological requirements and maximize their performance through optimal use of data (Souza and Rose, 2024). Thus, to support the implementation of the proposed strategic recommendations, it is necessary to deepen the understanding of the essential dimensions of data management, given the complexity of this concept, which encompasses various activities, such as the integrated management of data from various sources, quality assurance, and governance. Addressing these aspects, along with the development of an efficient storage system architecture, is essential to support organizations in quickly adapting to new technological challenges and maximizing data value to improve performance.

4. Findings

4.1. Data Management Dimensions and Core Capabilities

Data management is a multidimensional concept that captures activities from several angles including data storage, data integration from multiple source systems, data quality, data governance, data storage system architecture or database management systems.

Data Governance is one of the main capabilities of data management and refers to the management of security, availability, integrity, and use of data. One of the main objectives of data governance is to remove the use of siloes data in organizations and use it in a documented and centralized way. This decentralized way of using data can arise primarily from the speed with which information is propagated across different systems, the use of data by different departments that do not have a centralized way of working or an architecture that helps better coordination and synchronization. Data governance aims to harmonize these data from the systems through a collaborative process, with the participation of interested stakeholders from different angles of the organizations. Another goal of data governance is to ensure that data is used appropriately, both to avoid introducing potential data errors into systems and to block the misuse of personal data. This can be achieved by creating uniform data usage policies, along with procedures for monitoring usage and enforcing policies on an ongoing basis. In addition, data governance can help strike a balance between data collection practices and privacy mandates. In the context of data governance, skills are required to understand source data systems, functionally document technical variables, and take responsibility and ownership of data as it stands and any subsequent changes.

Another very important dimension of data management is data quality. Researchers were concerned about the quality of the data, so a number of 15 dimensions are identified (Wang and Strong, 1996), but later these were narrowed down to 6 with no less than 65 sub-dimensions (Black and van Nderpelt, 2020). These are: Accuracy, Completeness, Consistency, Timeliness, Validity and Uniqueness.

Data Integrity is the process of bringing together data from multiple sources with different formats to create a unified view. Data and digital transformation are in a symbiotic relationship. Thus, from the need to increase the skills of understanding data in the context of the aggressive digitization of society correlated with the financial performance of companies based on factual decisions, an index was developed to capture the degree of education in the field of data (Data Literacy Index). According to a study conducted by (QlikTech International AB, 2022), 76% of key business decision makers lack confidence in their data literacy skills.

As organizations become data-driven, poor data literacy will become a growth inhibitor. According to the Data Literacy Index, Europe has the highest score globally, where Germany, the UK or France are mature players in terms of data literacy. Although the values of this indicator are low in ASIA, Singapore stands out with the highest literacy rate worldwide.

From the desire to increase the financial performance of companies, they invest in the digital education of employees, this being a balance between technical and behavioural skills. Technical skills include programming languages (Python, R, SQL), data modelling methods, econometric analysis methods and tools, probability, and statistics. From the sphere of behavioural skills, we can mention creativity, critical thinking, teamwork, storytelling, or the ability to react quickly and solve problems.

4.2. Business Trends and How Higher Education Can Answer to the Needs

Data literacy has become a mandatory skill for all the organizations data-driven. Smart strategy consists in shaping the future and answering to the business needs relying on available means. Main purpose of our study is to create a framework to assess skills level in a company and how this can be improved with a cross collaboration between private and public business and higher education system.

In order to assess the level of data literacy of employees is the definition of a skills matrix. The steps to obtain such an array would be:

- Establishing the skills needed in the organization/project – avoid mentioning irrelevant skills
- Assessing the skill level of each subject in the sample or total population – using a 360-feedback form to avoid over- or under-estimation
- Assessing the direction of development of interest for each subject in the sample or total population
- Organizing the information obtained at the previous points in a matrix

Applied to data management core capabilities, a proposal for such a matrix can have the following format:

Table no. 1 Data matrix skills

		Topic 1	Topic 2	Topic 3	Topic 4	Topic 5	Topic 6
		Seniority level/interest	Seniority level/interest	Seniority level/interest	Seniority level/interest	Seniority level/interest	Seniority level/interest
Hard skills	Data architecture						
	Databases						
	Data integrity						
	Data governance						
	Programming						
	Data modelling						
	Probabilities and statistics						
	Econometrics						
Soft skills	Team work						
	Creativity						
	Critical thinking						
	Analytical mindset						
	Stakeholders management						
	Storytelling						

Source: Authors research

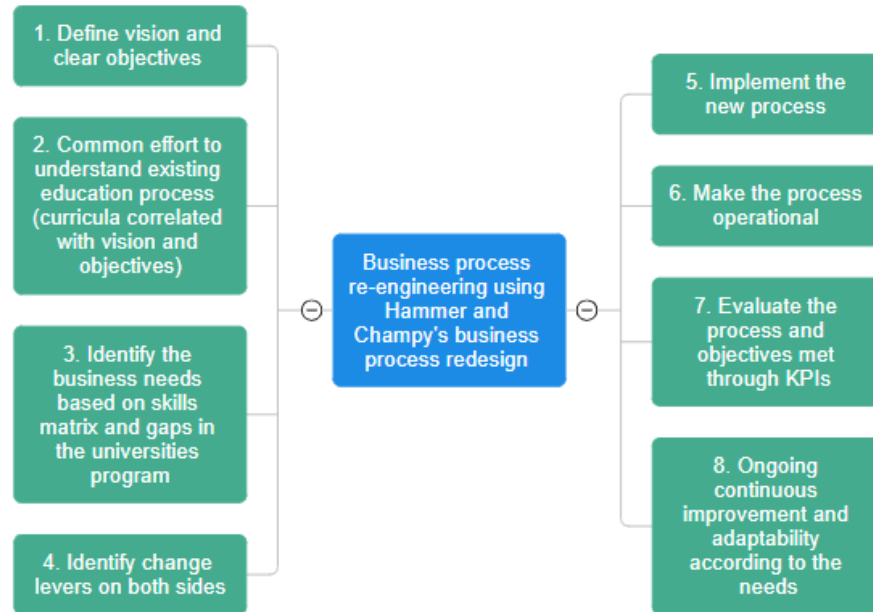
The skills matrix is telling a story about current data literacy level can be increased and to have impact in an organization the main thing to do is to start in an early phase to educate people before a project wrap ups or bad financial figures happens.

Even though data literacy is an important pillar for data driven organizations transformation, most of them lack this set of skills. One of the potential mitigation solution would be the education around data literacy even from high school supported by universities. When it comes about the direction of universities to support the optimization of the skills needed by public and private businesses, the operating model between the two big entities should answer to those strategic questions:

- What transformation is needed?
- What is the optimization that can be done to the current state?
- What are the risks by not taking any action or what would be the consequences of a late reaction?

To support data driven organizational changes, universities should redesign their strategy in terms of set of skills provided. Following Hammer and Champy's business process redesign, this process would consist in a sequence of steps and close collaboration with companies (Figure no. 2).

Figure no. 2 Hammer and Champy's business process redesign model



Source: Authors research

There are two main categories of actions to be taken: first of all, the collaboration between universities and companies should happen under clear objectives and a common understanding of existing gaps from both sides.

The goal is to filled-in those gaps and keep students motivated and engaged in a learning curve with clear outcome. For instance, one of the possibilities in case if a skill is missing (Eg. Data quality) an option is that the company team up with a proxy university and create a program that will allow students to have access to the corporate universe and business by applying their knowledge and even doing trainings to increase it in order to answer to the need. In this way the learning curve is applied on business needs.

5. Conclusions

Increasing data literacy skills and data-supported capabilities is a strategic answer to answer as society. More and more companies are investing in AI that rely on excellent data capabilities that will help to have better results but with resources spent in a more efficient way. In executing this strategy, a reliable partner is higher education with the mission to adapt their programs to develop specialized human capital ready to integrate on the labor market.

Thus, within organizations, an approach is needed that allows the integration of data analysis and, implicitly, new emerging technologies (Davenport, 2006; Benjamin, Amajuoyi and Adeusi, 2024). All of this requires, on the one hand, employee skills to make informed decisions and, on the other hand, provides a competitive advantage in the business environment because of their ability to easily adapt to customer preferences or changing market conditions (Hammer and Champy, 1993; Hossain et al., 2024). In this regard, universities must include in their curricula programs that are developed

in collaboration with the business environment to help future employees/leaders adopt a continuous learning mentality.

Lifelong learning is essential for individuals, especially in the context of technological change, when it is important not only to succeed in the labor market but also to be able to exercise optimal professional and intellectual capacity. Thus, joint projects can be conducted through partnerships with universities and educational institutions to reduce skill gaps (OECD, 2021). Also, the results of such collaboration are beneficial to all actors involved. In the case of teachers, they can understand the demands of the labor market and teach practical skills (World Economic Forum, 2020).

Lack of action or delay in transformation can have negative consequences at both personal and organizational levels. The lack of immediate educational reform can limit the acquisition of the necessary data literacy skills at the individual level, which, at the organizational level, is reflected in limiting productivity and competitiveness (QuantumBlack AI by McKinsey, 2022; McKinsey - AI & Analytics, 2024). If a company with a data-driven culture encourages continuous improvement of organizational performance and integrates new technologies into its activities, it is necessary to have motivated employees with relevant skills so that they can create truly differentiated experiences for customers and employees, will always adapt to market demands, and will exclude the risk of being overtaken by the competition (Gartner, 2024b; 2024a).

The role of education is also important, with universities being considered a fundamental pillar in supporting organizational change, adopting the business process redesign model proposed by Hammer and Champy (1993). This requires a rethinking of traditional methods and the development of close industry and business collaborations. Thus, in addition to promoting online learning and micro-level certification, an interdisciplinary approach is needed that combines data science, which would highlight the fact that the partnership between academia and industry is essential for innovation and workforce training (Moldoveanu and Narayandas, 2019).

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The Economic Impact of Artificial Intelligence in Medical Imaging

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Abstract

This study examines the economic impact of artificial intelligence in medical imaging, analyzing market trends and implementation mechanisms. The research reveals significant market growth, with the U.S. AI healthcare sector projected to reach USD 187.7 billion by 2030, growing at a CAGR of 35.8%. Analysis of workflow optimization demonstrates substantial efficiency gains, with reading time reductions up to 52.57% in concurrent reading scenarios and contouring time improvements between 30-50%. These findings indicate AI's transition from emerging technology to essential healthcare tool, suggesting continued innovation and value creation in medical imaging applications.

Key words: artificial intelligence, medical imaging, economic impact, healthcare market, workflow optimization

J.E.L. classification: O33, M15

1. Introduction

Artificial Intelligence stands as a transformative force in the global economy, with projections indicating potential value generation of \$2.6 trillion to \$4.4 trillion annually across analyzed use cases (McKinsey & Company, 2023). By 2030, the cumulative global economic impact of AI adoption is expected to reach \$19.9 trillion, driving 3.5% of global GDP (IDC, 2024). The technology demonstrates remarkable efficiency in value creation, with every new dollar invested in business-related AI solutions projected to generate \$4.60 in economic returns by 2030 (IDC, 2024).

The integration of Artificial Intelligence (AI) in healthcare represents a transformative force, with potential to revolutionize patient care while generating substantial economic benefits. Recent studies estimate healthcare cost savings of 5% to 10% through AI adoption, equivalent to \$200-360 billion annually in the United States alone (Sahni et al., 2024). Within this landscape, medical imaging emerges as a particularly promising domain for AI implementation, with the market valued at \$1.01 billion in 2023 and projected to reach \$11.76 billion by 2030.

In this study, we conduct a comprehensive analysis of AI's economic impact specifically within medical imaging, examining both market dynamics and value creation mechanisms. Our research aims to bridge the current gap in economic impact studies, as identified by systematic reviews showing that only 6 out of 66 publications contained substantial economic analysis (Wolff et al., 2020).

2. Theoretical background

The adoption of AI in healthcare has been characterized by rapid technological advancement coupled with careful implementation considerations. In medical imaging, AI applications span across multiple modalities including X-ray, CT, MRI, and ultrasound, with particular emphasis on workflow optimization and diagnostic accuracy enhancement (Pinto, 2023).

The industry landscape shows significant investment, with more than half of AI/ML-based medical devices approved in the USA and Europe between 2015-2020 being focused on radiological applications (129 (58%) devices in the USA and 126 (53%) devices in Europe). Studies demonstrate

AI's ability to meet or exceed human expert performance across multiple specialties, including pneumonia detection in radiology, dermatological classification, and cardiac diagnostics (Bajwa et al., 2021).

3. Research methodology

Our study employs a systematic analysis to evaluate the economic implications of artificial intelligence integration in medical imaging, with a dual focus on market dynamics and value creation mechanisms. Our research examines both the quantifiable economic impact and the underlying factors driving this transformation.

The data collection process relies on comprehensive market surveys and analytical reports from established research organizations including McKinsey & Company, IDC, Grand View Research, and Allied Market Research. These sources provide validated market projections, growth rates, and economic indicators based on rigorous industry analysis and primary research methodologies. The medical findings and clinical impact assessments are derived from extensive meta-analyses and systematic reviews of peer-reviewed literature.

Our study focuses on the U.S. AI healthcare market, given that North America dominates the global market, accounting for 43% of revenue share in 2023 (Grand View Research, 2024). This dominance is attributed to advanced healthcare infrastructure and significant investment in healthcare technology.

4. Findings

The integration of AI in medical imaging represents a significant economic transformation in healthcare delivery. Our analysis reveals substantial market growth coupled with measurable improvements in operational efficiency and cost reduction through various mechanisms.

The AI medical imaging market demonstrates significant growth and economic potential. Current market valuations vary across research firms, with 2023 valuations ranging from \$1.01 billion (Grand View Research, 2024) to \$2.34 billion (Maximize Market Research, 2024). Projections indicate substantial growth, with expected valuations reaching between \$11.76 billion to \$29.8 billion by 2030-2033, representing a compound annual growth rate (CAGR) of 28.19% to 32.1% (Globe Newswire, 2024; Sumant, 2024).

The U.S. AI in Healthcare market demonstrates significant growth potential across three key components: software solutions, hardware, and services. As illustrated in Figure 1, the market value started at approximately \$2 billion in 2020 and is projected to reach \$9.7 billion by 2030, with a compound annual growth rate (CAGR) of 35.8% from 2024 to 2030 (Grand View Research, 2024). Software solutions represent the largest segment, showing consistent growth throughout the decade, while hardware and services components also display steady expansion. This upward trajectory reflects the increasing adoption of AI technologies in healthcare settings, with software solutions leading the digital transformation of the healthcare industry.

The economic returns from AI implementation in medical imaging demonstrate substantial value creation across multiple dimensions. Analysis of five-year performance metrics reveals a basic implementation ROI of 451%, which increases significantly to 791% when accounting for radiologist time savings (Bharadwaj et al, 2024).

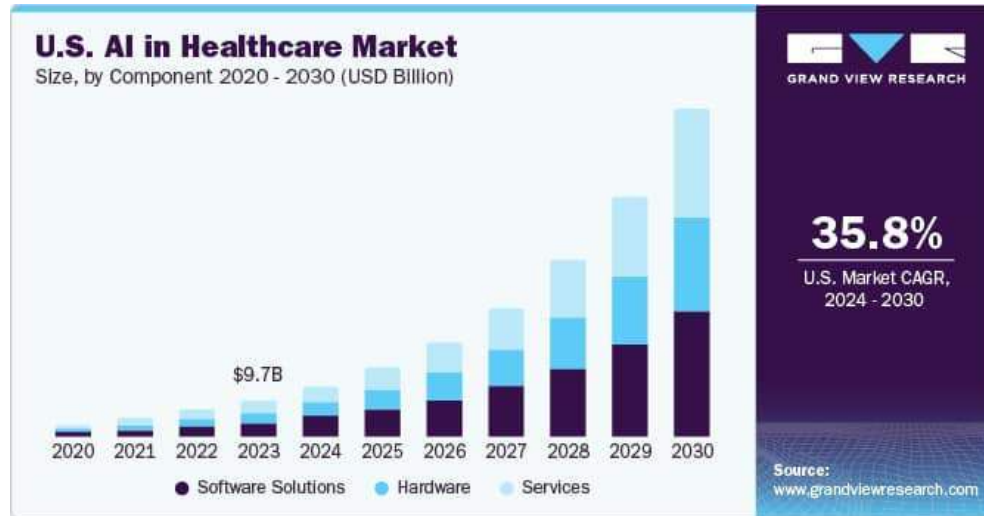
Revenue generation and cost reduction mechanisms manifest through several channels. Healthcare facilities report annual cost savings of approximately \$1.2 million through reduced staff overtime and error mitigation. Additional revenue streams emerge from increased patient throughput, generating an average of \$800,000 annually.

4.1 Mechanism

The adoption of AI in medical imaging has evolved into distinct implementation categories, each serving specific clinical needs. A couple of major AI applications emerge in the space of medical imaging, based on their role in the medical treatment, aiming both to optimize the workflow and improve patient outcomes:

- Triage AI applications
- Productivity AI applications
- Augmented AI applications

Figure no. 1 U.S. AI in Healthcare Market Size by Component (2020-2030)



Source: Grand View Research (2024)

Triage AI focuses on prioritizing urgent cases and managing workflow efficiency, with studies showing reduction in turnaround time from 11.2 days to 2.7 days for critical findings (Najjar, 2023). The integration of AI triage systems has demonstrated significant improvements in patient prioritization, with accuracy rates of 80.2% in predicting triage preparation (Tyler et al., 2024).

Productivity AI enhances operational efficiency through workflow optimization and resource management. Studies indicate that AI implementation can reduce MRI scan times from 60 to 15 minutes while maintaining diagnostic quality (Behl, 2024).

Augmented AI in medical imaging can be categorized into two primary functions: support applications and diagnostic assistance. Support applications enhance workflow efficiency by automating time-consuming tasks, such as organ and automated measurements of anatomical structures (Binarijs, 2024). These tools allow medical professionals to focus on complex clinical decisions while maintaining accuracy. Diagnostic assistance applications serve as concurrent second readers, providing rapid analysis alongside human interpretation. This dual approach of support and diagnostic assistance creates a synergistic relationship between AI and healthcare providers, rather than replacing human expertise. Research shows that AI tools used as concurrent second readers can significantly improve diagnostic accuracy (Wenderott et al., 2024). In clinical trials, AI-assisted image-guided procedures consistently outperformed conventional methods, particularly beneficial with smaller targets and complex procedures (Christie, 2024).

Based of the metaanalysis by (Wenderott et al., 2024), the implementation of AI in medical imaging workflows demonstrates varying impacts on processing times across different tasks and implementation approaches. Analysis of 36 studies reveals that AI concurrent assistance reduced reading times by an average of 27.20%. The most significant improvements were observed in triage applications, where time reductions ranged from 73.08% to 96.29% for critical cases. Contouring tasks consistently showed substantial improvements, with time reductions between 30% and 50.80%. However, the impact of diagnostic AI varies by workflow type based on when the AI is introduced in the medical imaging workflow:

- **Triage Applications:** AI prioritizes cases before human reading, reducing turnaround time from 11.2 days to 2.7 days for critical findings
- **First Reader:** AI performs initial analysis before human review, demonstrating positive efficiency impacts across imaging modalities

- **Concurrent Reading:** AI analysis happens simultaneously with human interpretation, showing efficiency gains with reading time reductions up to 52.57%
- **Sequential Reading:** Radiologist completes interpretation first, followed by AI analysis, often increasing total processing time due to the step-by-step nature

While first reader and concurrent second reader implementations, in which AI is applied on the medical images from the beginning of the medical evaluation, generally showed positive results, whilst sequential reading sometimes led to increased times.

Table no. 1. Impact of AI Implementation on Various Medical Imaging Tasks.

Task Type	Average Time Reduction	Range of Impact
Reading Time	27.20%	-52.57% to +28.73%
Contouring	41.75%	-30.00% to -50.80%
Wait Time (Triage)	42.35%	-9.74% to -89.61%
Report Turnaround	18.02%	-22.22% to +19.94%

Note: Negative values indicate improvements (time reduction) and positive values indicate increased processing times.

Source: Author's contribution

5. Conclusions

The U.S. AI healthcare market demonstrates remarkable growth potential, projected to reach \$187.7 billion by 2030 with a CAGR of 35.8% (2024-2030). Software solutions maintain market dominance, while hardware and services segments show steady expansion, indicating balanced ecosystem development. This sustained growth trajectory, particularly accelerating post-2025, reflects healthcare providers' increasing confidence in AI technologies and suggests their fundamental integration into modern medical practice. The market's evolution from approximately \$2 billion in 2020 to its projected value in 2030 demonstrates AI's transition from an emerging technology to an essential component of healthcare delivery systems, with strong potential for continued innovation and value creation.

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Artificial Intelligence and Organizational Stress: Bibliometric Analysis

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Abstract

Artificial intelligence (AI) is an emerging technology. In recent years, organizations are increasingly using or considering the use of AI applications. This brings both considerable benefits and significant challenges for employees and organizations. This article examines the influence of AI on human resources in the organisation, highlighting both positive and negative impacts. The study includes a bibliometric analysis of the literature using Google Scholar scientific publications from 2014 to 2024 on Artificial Intelligence and stress, identifying key areas where AI may be a determinant of stress.

Key words: artificial intelligence, human resources, bibliometric analysis, stress

J.E.L. classification: M15, O15

1. Introduction

Technology has always played a crucial role in the development of societies and in the transformation of business environments. A recent example of technological challenge and innovation is artificial intelligence (AI), which is revolutionizing the concept of business productivity. From automation and machine learning to natural language processing and augmented reality, AI is starting to fundamentally change the way companies create and manage activities. The use of AI has varied purposes, from augmenting human capabilities and automating repetitive tasks to generating predictions and recommendations.

Artificial intelligence (AI), as it is understood in today's organizational context, encompasses a set of technologies designed to replicate human cognitive processes, thus enabling improved problem-solving and task execution capabilities. More specifically, AI can be defined as a suite of interconnected technologies geared towards performing tasks or solving problems that, when driven by humans, require cognitive processes. These include capabilities such as machine learning algorithms for recognizing patterns in large datasets, natural language processing tools for text mining and classification, and decision support frameworks that augment human decision-making abilities. Most studies on AI have focused on its potential benefits, such as optimizing operations, increasing productivity, boosting innovation, and facilitating decision-making processes.

It represents a huge potential for human progress. The technology offers significant opportunities to understand and solve some of the biggest challenges we face. Focusing on ethical AI and integrating it appropriately into the workforce are key approaches to building trust and overcoming current perceptions of this emerging technology. It is important to recognise that technology exists to improve the quality of life of employees, not to create stress and anxiety.

2. Literature review

According to a recent report from Gartner, senior executives view data analytics and artificial intelligence (AI) as key transformational enablers that enable companies to survive crises. Despite the excitement about the potential of AI, there is currently substantial academic discussion about the barriers to its adoption, as well as the skills needed to achieve useful strategic outcomes. AI can bring

significant benefits to companies, but to deploy AI effectively and achieve major impact without undoing all the costs and effort involved, organizations need to define a compelling shared vision when fundamental change is needed. Companies also need to utilize various distinctive technologies, such as AI, to build adaptive transformations and understanding and response capabilities that will drive innovation, improve customer service and experience, and promote superior performance.

According to a study by the American Psychological Association (APA), the use of Artificial Intelligence (AI) and monitoring technologies in the workplace can reduce employee comfort, decrease employee efficiency, and diminish confidence in their professional abilities.

Artificial intelligence anxiety is a new term, introduced by a marketing agency and already popularised on social media, describing the stress and worry generated by the rapid advance of artificial intelligence technology.

Even technology experts have been surprised by the recent rapid growth of new technologies capable of replacing human conversations in multiple languages, creating music and facilitating medical diagnosis. While the potential benefits of artificial intelligence in areas such as healthcare are remarkable, the accelerating pace of change creates considerable uncertainty about the future. This uncertainty can fuel concerns about the impact on individual careers, data privacy, safety and the influence of intelligent robots on human creativity and innovation.

Anxiety about artificial intelligence often stems from this uncertainty, such as concerns about AI's potential to generate fake videos or spread misinformation, contributing to polarised public opinion. Some AI-generated content can also provoke negative emotional reactions among employees. F

These feelings are not new; similar concerns about technological advances, such as 'computer phobia', 'computer anxiety' and 'technology stress', have been around since the 1980s. In many ways, AI anxiety can be compared to the environmental anxiety felt by many young people in the face of climate change. Like environmental degradation, rapid digitisation is the result of human activity, and many employees now feel that both phenomena are developing.

Excessive worrying can disrupt activities within the organisation and contribute to health problems, while preventing recognition of the positive effects of evolving artificial intelligence. Employees can benefit from AI's capabilities while at the same time feeling threatened by its demands, thus exacerbating symptoms of stress.

Technostress refers to the stress people experience due to their inability to cope with new technologies. Tarafdar et al. extended the technostress theory to explain how technology can lead to role overload, invasion of privacy, role ambiguity and job insecurity, which are significant stressors in the context of AI adoption. Employees can feel overwhelmed by the demands of continuous learning and the rapid pace of technological change. In the context of workplace stress and physical health, sustained periods of stress not only deplete psychological resources but also, over time, erode physical vitality, leading to pronounced declines in physical health.

3. Research methodology

This article explores the Artificial Intelligence - stress relationship. The integration of Artificial Intelligence into organisational environments can cause stress to human resources through rapid change in work processes and pressure to adapt skills to new technological requirements. Also, concerns about data security and the consequences of automated decisions can contribute to organisational tensions and increased stress. Stress associated with AI can have significant mental health consequences. Anxiety, burnout and other mental health problems can arise as a result of constant pressure and job insecurity.

One of the frequent research methodologies for analyzing an extended topic and tracking its evolution over a period of time (2014-2024) is bibliometric analysis. In this context, such an analysis is carried out based on the publications available on Google Scholar from 2014-2024.

To scan the existing literature, two key concepts were considered: "artificial intelligence" and "stress". The bibliometric analysis was performed using VOSviewer software, version 1.6.15, a free tool used for creating and viewing bibliometric maps. VOSviewer is increasingly popular among business and management researchers for conducting systematic reviews, either as a single tool or in combination with other methods.

The results obtained from WoS (Web of Science) containing complete records were exported to VOSviewer and used as a data source for generating new maps. Text data was used to construct term co-occurrence networks, and bibliographic data served to create keyword co-occurrence networks. The study presented a bibliometric analysis of the scientific literature related to artificial intelligence and stress, identifying the relationships between these two fields.

4. Findings

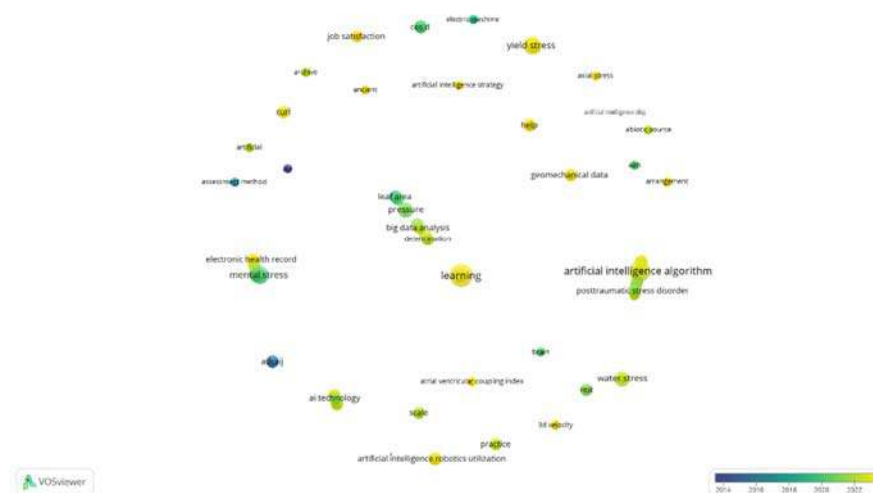
The Google Scholar search using the terms “Artificial Intelligence” and “stress” identified a total of 1000 publications. These data were imported into VOSviewer to allow the construction of bibliometric maps, thus supporting further analysis. All figures presented in this section were generated using the VO tool

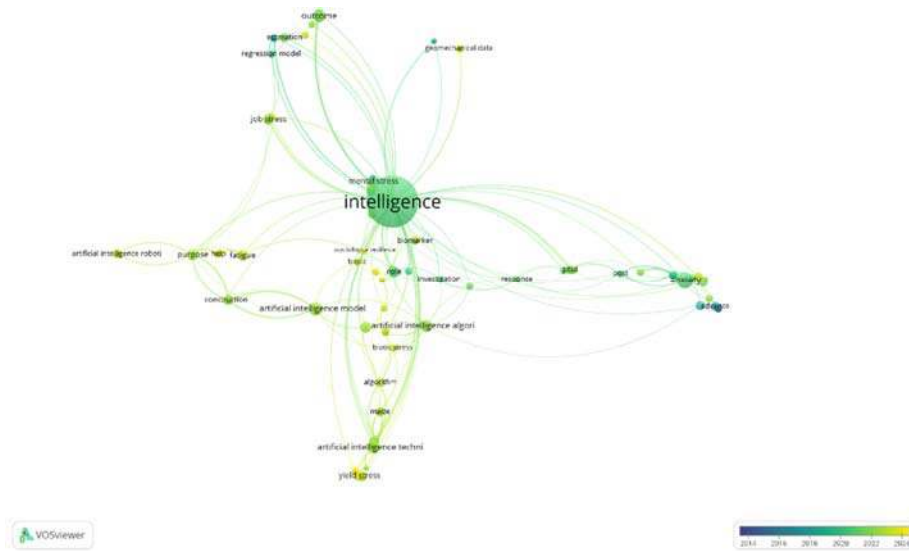
For the entire analyzed time interval (2014–2024), the "text data-based term co-occurrence map" (Figure 1) identified 433 elements, distributed in 40 clusters. These generated 1827 laws and a total power of laws of 2174. Among the most significant elements within these clusters are:

- Cluster 1 (21 items): artificial intelligence, decision tree, engineer, stress level, stress recognition, task;
- Cluster 2 (18 items): artificial intelligence, biomarker, opportunity, stress condition, stress levels, usability;
- Cluster 3 (16 items): abiotic stress management, learning, model plant stress, psychological stress;
- Cluster 4 (25 items): artificial intelligence, big-data analysis, big data integration, data source, work stress;
- Cluster 5 (21 items): artificial intelligence, digital measurement, effort, employee stress, maximum stress, strong stress;
- Cluster 6 (9 items): axial stress, combination, computing power, deep learning algorithm, masonry building, traditional method;
- Cluster 7 (8 items): artificial intelligence method, cardiac activity, healthy subject, help, human daily life activity, physiological stress;
- Cluster 8 (7 items): artificial intelligence robotics utilization, burnout, relationship, wellbeing.

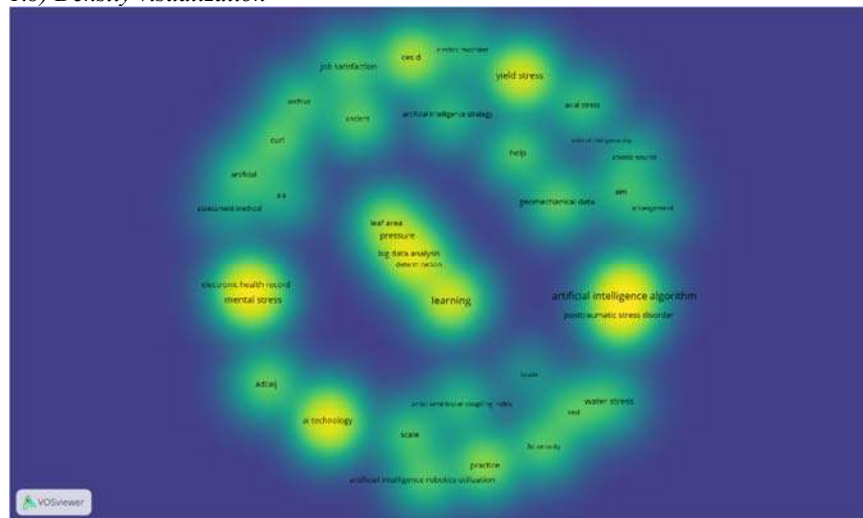
Figure no. 1 Co-occurrence map of terms based on text data (2014- 2024)

1.a) Network visualization





1.b) Density visualization

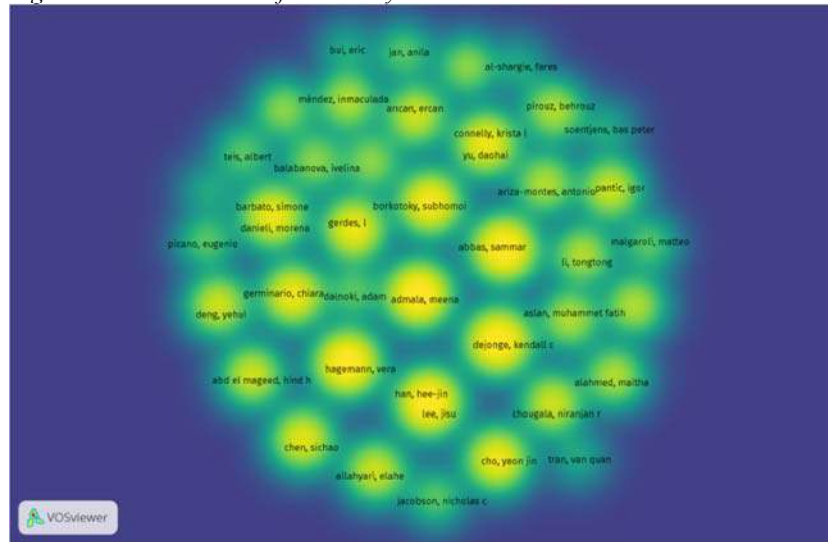


Source: Developed by the authors

The term co-occurrence map is a useful tool in text analysis that visualizes the relationships and frequencies of co-occurrences of specific terms. Making such a map between the terms 'stress' and 'artificial intelligence (AI)' provides valuable insights into the interactions and mutual influences between these concepts. Each dot represents a term, and the intensity of the colour (green to yellow) indicates the frequency of occurrence and connections with other terms. The key term and connection 1 is represented by the AI algorithm and is connected with the term post-traumatic stress disorder.

The geographical distribution of literary works, presented in figure 2, shows that a significant proportion of the publications are made in China.

Figure no. 2. Production of articles by authors



Source: Developed by the authors

Figure 2 shows the relationships between authors who have collaborated or been mentioned together in research papers on the topics of 'stress' and 'artificial intelligence (AI)'. Areas with more intense colours (yellow) indicate the centre of frequent collaboration between authors. These areas suggest groups of researchers who frequently collaborate and have a significant impact in the field studied (e.g. Sammar Abbas and Kendall de Jong are highlighted as the centre of collaborative networks, suggesting a leading role in research on stress and Artificial Intelligence). Artificial Intelligence (AI), one of the most transformative technologies of the 21st century, influences multiple aspects of daily life and professional activities. While AI promises efficiency, accuracy and innovation, its impact on mental health and stress is a growing concern. This can also be seen from the bibliometric analysis conducted.

5. Conclusions and forecasts

In the analysis performed, we grouped the keywords and used them to identify the relevant articles, obtaining the following results: Artificial Intelligence brings innovation and efficiency in various fields, but its impact on employee stress and mental health cannot be ignored. It is essential that organizations manage these impacts through appropriate policies, retraining programs and psychological support, thus ensuring a balanced and healthy work environment for employees. Recognising and addressing these issues can contribute to a smoother transition to a digitised economy and a harmonious integration of AI technology into working life. Continued research into the relationship between Artificial Intelligence and organisational stress will bring significant benefits in the future. They will not only help to gain a deeper understanding of the impact of technology on employee mental health, but will also provide practical solutions to create healthier and more productive work environments.

Research should highlight that Artificial Intelligence relies on collaboration with humans to improve the workforce, not replace it. However, it is important to talk about the benefits of AI and to develop strategies to develop AI towards benefits for society. The advancement of digital technologies involving wearable devices, smartphone apps and machine learning and AI offers a unique opportunity to accelerate the field of stress research and use AI for evidence-based care. These complementary approaches could provide the tools to identify a multidimensional longitudinal measure of employee stress response in an organizational setting..

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The Influence of the Shadow Economy and Corruption on Public Debt in European Union Countries pre and post Covid-19

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Abstract

This study aims to analyze the influence of the shadow economy and corruption on public debt in EU countries pre- and post-COVID-19, during 2003-2021, focusing on the challenges arising from recovery efforts after the COVID-19 pandemic. Using the GMM model, the results indicate that the informal economy has a negative impact on public debt in most models, while corruption increases the accumulation of debt. GDP per capita also negatively impacts debt, while unemployment rates are positively associated with an increase in debt due to social expenditures. Inflation and investment negatively impact debt, while population growth and trade exhibit complex effects. The study recommends stimulating the transition to the formal economy, improving transparency and combating corruption, enhancing economic growth, controlling inflation, supporting public investment, and promoting international trade to address public debt challenges.

Key words: informal economy, corruption, public debt, GDP, GMM model

J.E.L. classification: H63, E62, O11, D73, O52

1. Introduction

In the wake of the recent economic crisis, countries worldwide have witnessed a notable upsurge in their public debt levels particularly following the global economic crisis of 2008. This trend is especially pronounced among advanced nations. It is essential to highlight, as pointed out by a referee, that the considerable increase in public debt, particularly after the 2007/08 crisis, can be largely attributed to the nationalization of private debt. Several countries, such as Japan, Greece, and Italy, have surpassed a debt ratio of 1.0. This persistent growth in public debt has raised serious concerns about fiscal sustainability and its potential impact on the economy. Scholars like Reinhart and Rogoff (2010) have suggested a recommended threshold for public debt, emphasizing the need for countries to stay below it to avoid the risk of default. The concerns surrounding the rapid escalation of public debt levels likely stem from the perceived potential for adverse effects on economic growth. Given that governments strive for sustainable growth as a primary objective, researchers have shown keen interest in studying public debt levels and their consequences on diverse economies. Researchers arguably consider public debt a necessary condition for achieving sustainable growth (Kim et al., 2017).

In recent decades, countries, both developed and developing, have been contending with significant challenges arising from public debt and the shadow economy. The expansion of the shadow economy, which encompasses unreported employment, production, and exchange activities beyond government oversight, has become a pressing concern for policymakers due to its impact on macroeconomic stability (Schneider, 2000:81).

Despite efforts and notable difficulties in curbing its growth, the shadow economy remains an emerging issue of high priority for policymakers. This concealed sector continues to constitute a substantial and expanding portion of global economic activity. Alongside this, public debt poses another critical challenge that compounds the complexities faced by governments. Regardless of a country's developmental stage, most nations have experienced the consequences of their borrowing policies. This is particularly true in transition countries, where fragile market structures contribute to volatile economic performance. The repayment of public debt and the subsequent rise in

government spending further magnify the dimensions of this problem, especially in underperforming economies.

Corruption represents one of the most serious challenges facing economic development and financial stability in countries. Corruption is defined as the exploitation of public authority for personal gain, and it is a phenomenon that affects various aspects of political, social, and economic life. In the economic context, public debt is considered one of the areas most affected by corruption, as it leads to increased financial burdens on countries due to the mismanagement of resources and their waste on ineffective projects or their exploitation for the benefit of individuals or narrow groups. The relationship between corruption and public debt manifests in several forms, including unjustified increases in government spending, decreased efficiency in collecting public revenues, and higher borrowing costs due to deteriorating confidence in the economy. Additionally, corruption hinders investment and reduces economic growth, which in turn exacerbates the public debt problem and weakens countries' ability to meet their financial obligations and achieve fiscal sustainability.

While there is a substantial amount of research exploring the relationship between the shadow economy, corruption, and public debt, a significant deficiency persists in the literature regarding European Union (EU) nations. Insufficient research persists regarding the impact of the shadow economy and corruption on public debt within EU nations, which exhibit markedly diverse political, economic, and institutional frameworks. Furthermore, the evolving landscape of the EU, particularly in light of recent developments such as the economic impacts of the COVID-19 pandemic, highlights the necessity for additional inquiry to deepen our comprehension of the specific mechanisms by which the shadow economy and corruption may affect public debt levels in EU nations. Therefore, it is essential to conduct further empirical studies to address this research gap and yield meaningful insights into the complex interplay between the shadow economy, corruption, and public debt within the context of the EU.

This paper seeks to explore the influence of the shadow economy and corruption on public debt within EU nations, beginning with the subsequent pivotal question: How do the shadow economy and corruption influence public debt within the member states of the European Union? The objective is to measure the impact of the shadow economy on the growth of public debt while considering the diverse economic resilience and governance structures within the EU. Furthermore, the research examines the influence of corruption in intensifying public debt, especially in periods of increased economic pressure. The research aims to offer empirical insights and policy recommendations, thereby guiding policymakers in devising effective strategies to tackle these challenges and promote sustainable economic recovery and governance integrity throughout EU member states.

2. Literature review

Research indicates the substantial and interrelated impacts of the shadow economy and corruption on public debt levels in EU nations. Empirical evidence indicates that both factors contribute to rising public debt, with the shadow economy exerting a more significant influence than corruption, as evidenced in Spain (Gonzalez-Fernandez and González-Velasco, 2014). Analysis across various countries indicates that corruption amplifies the effects of government expenditure and the shadow economy on debt levels (Cooray et al., 2017). The financial systems of the EU influence net receiver countries, which typically exhibit weaker incentives to tackle shadow economic activities than net contributors. This disparity negatively impacts public revenues and debt management (Herwartz and Theilen, 2013).

In transition economies within the EU, the relationship between corruption and public debt demonstrates a bidirectional causal link, wherein enhanced governance and diminished corruption correspond with improved fiscal outcomes (Ozturk, 2021).

In African nations, both factors exhibit a positive and significant correlation with increasing public debt, with causality indicating their role as drivers (Owusu-Nantwi and Owusu-Nantwi, 2021).

In Arab countries, corruption exacerbates debt in low-democracy contexts, with larger shadow economies enhancing this impact (Baklouti and Boujelbene, 2021). The shadow economy

exacerbates the negative effects of corruption on public debt, suggesting a complementary relationship between these elements (Dumitrescu et al., 2021).

In recent decades, there has been an increasing focus among researchers and scholars on the study of the shadow economy. Several studies have concentrated on measuring its extent across various countries and regions, demonstrating the significance of this research interest (Giles, 1999; Schneider, 2005; Orviská et al., 2006; Tafenau et al., 2010). This field of research has received heightened focus owing to the substantial effects the underground economy exerts on the public finances of a country or region. A comprehensive analysis of the shadow economy allows authorities to implement suitable economic policies, thereby mitigating potential distortions.

Theoretical research has examined the causes and consequences of the underground economy (Schneider and Enste, 2000). The underground economy influences public finances through its effects on both expenditure and revenue. The shadow economy adversely impacts public finances by diminishing tax revenues and requiring supplementary measures to offset the revenue deficit. This may lead to a transition from the formal to the informal sector, exacerbating public finances (Arrazola et al., 2011). The underground economy can result in misguided expansionary policies stemming from distorted indicators, including the underestimation of GDP and the overestimation of unemployment. Moreover, an expansion of the informal economy results in increased social transfers, subsequently raising levels of public expenditure. The shadow economy has a dual detrimental effect on a nation's public finances by diminishing revenues and artificially increasing expenditures. This belief underscores the role of the underground economy in exacerbating the decline of public finances (Yereli et al., 2007), with a primary effect on debt levels. Authorities need to understand the dynamics of the informal economy and develop suitable public policies to mitigate debt and improve revenue. Marcos and Carmen (2014) identified a significant positive correlation between the size of the shadow economy and regional public debt. Moreover, misaligned tax policies and inadequate governance linked to the expansion of the shadow economy lead to ineffective debt management, especially within currency unions where common monetary frameworks exacerbate vulnerabilities (Prinz and Beck, 2012).

The influence of corruption on public debt differs according to economic development, with advanced economies experiencing more significant increases due to their larger fiscal structures and greater dependence on institutional governance (Benfratello et al., 2018). Poor governance and ineffective tax administration exacerbate the impact of corruption, with studies indicating that mitigating corruption may reduce public debt by as much as 2% in certain OECD nations (Monte and Pennacchio, 2020). Corruption imposes direct costs on borrowing by negatively affecting bond ratings and increasing interest premiums, which ultimately jeopardizes fiscal sustainability (Depken and Lafountain, 2006). Corruption continues to be a widespread issue globally (Goel and Nelson, 2010). The media presents numerous corruption stories daily, which are intensified by the ongoing financial crisis.

Transparency International, the entity that generates a prominent corruption index, characterizes corruption as the misuse of entrusted power for individual benefit. A different definition describes it as the misuse of public authority for personal gain, bypassing established regulations (Jain, 2001). Addressing corruption necessitates a thorough comprehension of its fundamental causes (Dong and Torgler, 2011).

The literature includes studies examining corruption and its determinants. Treisman (2000) analyzes the factors that contribute to corruption in detail. His arguments suggest that the extent of corruption is contingent upon the equilibrium between the costs incurred from participating in corrupt activities and the benefits obtained from such actions. The costs encompass social and psychological factors, including culture and religion, alongside the risks associated with punishment or detection, reflecting the deterrent effect. Benefits correlate with national characteristics, including the extent of government intervention and the degree of political stability. Public expenditure serves as an economic indicator frequently linked to corruption. Del Monte and Papagni (2007) analyze the factors influencing corruption across 20 Italian regions from 1963 to 2001, employing the incidence of crimes against public administration as an indicator of corruption.

The findings indicate that government expenditure and regional development levels affect the prevalence of corruption, in addition to cultural and political factors. Mauro (1998) analyzes public expenditure components utilizing diverse country samples and data sourced from other researchers. The findings indicate that corruption is associated with decreased education expenditure in the analyzed countries. Mauro posits that specific categories of public expenditure are more vulnerable to illegal rents and bribery, particularly highlighting technology-intensive items as especially prone to these offenses.

Benfratello et al. (2015) found that public sector corruption is associated with rising government debt. The effect varies across income-related sample splits, being more pronounced in advanced economies and less significant in less-developed countries. Yasmin (2021) identified a positive correlation between corruption and the accumulation of public debt in Asian and African nations, noting that this correlation is more pronounced in the African region. The research emphasizes the moderating effect of institutional quality on the relationship between corruption and debt. Existing literature has examined the relationship between corruption in the public sector and public debt through multiple studies. Elgin and Uras (2013) include variables related to corruption in their examination of the shadow economy and public debt. The study specifically incorporates indicators for corruption control and bureaucratic quality. The findings indicate a notable positive correlation between institutional quality and levels of public debt. They similarly observe an inverse relationship between debt levels and corruption control.

An extensive body of literature examines the factors influencing public debt, starting with Barro (1979). Barro's research, under the assumption of a benevolent government and utilizing a tax-smoothing framework, suggested that governments manage budget surpluses and deficits to mitigate sudden fluctuations in tax rates. This viewpoint indicates that the accumulation of public debt is primarily influenced by political and institutional factors. This perspective posits that public debt is a consequence of political dynamics (Alesina and Perotti, 1994). Battaglini and Coate (2008) proposed an alternative political economy theory of fiscal policy, emphasizing that policy decisions are determined by a legislature instead of a benevolent planner. This framework posits that if corruption increases the value of public goods, it will lead to a rise in debt, taxes, and public expenditure on goods and services.

Additional research has identified corruption as a major factor contributing to elevated public debt levels. Corruption manifests in multiple forms, resulting in diminished economic growth and heightened public debt. It enables individuals to access resources from central and local governments, leading to the distribution of public resources to those proficient in obtaining them rather than to the most capable entrepreneurs. This subsequently increases the cost of business operations and diminishes the effectiveness of business decisions. Tanzi and Davoodi (2002) asserted that corruption hinders growth by obstructing the development of small- and medium-sized enterprises, which has significant implications for public finances. Entrepreneurs are required to allocate time to engage in bribery, hindering the complete realization of the growth potential inherent in these enterprises.

3. Research methodology

This study examines the influence of the shadow economy and corruption on public debt in EU countries, characterized by varied political, economic, and institutional contexts that have yet to be thoroughly analyzed. This study emphasizes the necessity of understanding the specific mechanisms by which the shadow economy and corruption affect public debt levels, particularly in light of the evolving context of the EU and significant events such as the COVID-19 pandemic.

The analysis utilizes the Generalized Method of Moments (GMM) and encompasses data from 27 EU member states: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden, covering the period from 2003 to 2021. This study employs the GMM framework established by Nguyen, T.A.N., and Nguyen, K.M. (2022) to analyze public debt as the dependent variable. The independent variables considered are the shadow economy, corruption, GDP per capita, gross fixed capital formation, population growth, trade openness, inflation, and unemployment rates.

Table 1 delineates the variables included in our model, along with their acronyms, units, and data sources utilized to elucidate the correlation between shadow economy, corruption, and public debt.

Table no 1. The variables that were utilized in the model

Name of Variables	Abbreviation	Unit	Source
Dependent variables			
Public debt	DEBT	%GDP	Eurostat 2003-2021
Independent variables			
Shadow Economy	SE	%GDP	European Parliament 2003-2021
Corruption	CPI	Score	Transparency International 2003-2021
Gross domestic product per capita	GDP	constant 2015 US\$	World Bank 2003-2021
Unemployment rate	U	% the labor force	Eurostat 2003-2021
Inflation rate	INF	%Average Consumer Price	Eurostat 2003-2021
Gross fixed capital formation	GCF	%GDP	Eurostat 2003-2021
Population growth	POP	%Annual	World Bank 2003-2021
Openness of trade	TRD	%GDP	World Bank 2003-2021

Source: processed by author

The effect of public debt and institutional quality on economic growth has been analyzed by looking at the following model:

$$DEBT_{it} = \beta_0 + \beta_1 SE_{it} + \beta_2 CPI_{it} + \beta_3 GDP_{it} + \beta_4 U_{it} + \beta_5 INF_{it} + \beta_6 GCF_{it} + \beta_7 POP_{it} + \beta_8 TRD_{it} + \varepsilon_{it}$$

In the regression equation, *DEBT* is the public debt-to-GDP ratio, and the subscripts *I* and *t* represent the number of the countries and periods covered for the study respectively (*I*= 1-27 and *t*= 2003-2021). *SE* corresponds to the estimation of the shadow economy; *CPI* is the approximation of Corruption; *GDP* is – a proxy used for economic growth; *U* is the unemployment rate and *INF* is the inflation rate. *GCF* is the gross fixed capital formation is a percentage of GDP- a proxy for the investment in physical capital. *POP* is the population growth, *TRD* is the trade as a percentage of GDP and ε_{it} is the random variable.

This study examines the Shadow Economy (SE), defined as the regional value of the informal sector, positing a direct relationship between the volume of the shadow economy and public debt (Nguyen, T.A.N. and Nguyen, K.M., 2022). Corruption Perceptions Index (CPI) published by Transparency International. The corruption estimate ranges from 0 (totally corrupt) to 10 (not corrupt). Cooray et al. (2017) found that higher levels of corruption and a larger shadow economy contribute to an increase in public debt.

The regression analysis utilizes GDP per capita growth as a metric to evaluate the impact of economic growth on public debt.

Imran (2016) posits that enhanced economic growth leads to increased domestic revenue, thereby diminishing the necessity for borrowing. (*U*) represents the unemployment rate as indicated by the data. Unemployment leads to an increase in government spending on social benefits such as unemployment benefits, while at the same time, it reduces tax revenues due to the decrease in the number of workers and their incomes. This leads to an exacerbation of the budget deficit and an increase in public debt (Jahoda and Godarová, 2016).

The inflation rate (*INF*) is utilized to assess its effect on public debt. According to Imran (2016), rising inflation reduces the value of debt by offsetting increases in interest rates. Gross fixed capital formation (*GCF*) encompasses all types of investment in physical capital, including land improvements, equipment, and machinery acquisitions, construction of infrastructure such as roads and railways, and the establishment of educational and healthcare facilities, as well as residential and industrial buildings. It is frequently utilized as an indicator of the level of investment in physical capital within growth literature.

Law and Singh (2014), along with Belguith and Omrane (2017), indicate that gross fixed capital formation exerts a negative and significant influence on public debt. The population growth rate (POP) denotes the rate of increase in the number of individuals within a population. Jalles (2011) discusses population growth, indicating that in aging societies, it exacerbates the burden on public finances through increased health, pension, and social costs, which in turn contributes to elevated public debt levels (Ihori et al., 2006).

The trade-to-GDP ratio (TRD) reflects the significance of international trade within a nation, calculated by dividing the total monetary value of imports and exports by GDP over a specified period, usually one year. Furthermore, openness may diminish the efficacy of fiscal spending through its interaction with public debt levels, indicating that economies with high openness could encounter limitations in utilizing debt for economic stimulation (Deskarić & Šimović, 2017). This study utilizes dynamic panel GMM estimators as proposed by Arellano and Bond (1991) and further developed by Blundell and Bond (1998). This technique is chosen for its capacity to tackle the concurrent presence of bias and country-specific effects.

Table 2 presents the essential descriptors of the variables utilized across all EU27 countries from a statistical viewpoint.

Table no 2. Descriptive statistics EU27 countries

Variable	Obs	Mean	Std. dev.	Min	Max
DEBT	621	59.92	35.70	3.8	212.4
SE	540	19.46	7.25	6.1	35.9
CPI	615	33.96	30.47	2.6	92
GDP	621	2.32	4.04	-14.46	23.30
U	621	8.68	4.44	1.9	27.5
INF	621	2.88	3.67	-1.7	45.7
GCF	621	22.28	4.18	10.68	54.27
POP	621	0.2150	0.9027	-6.18	3.93
TRD	621	121.1	64.07	14.23	388.1

Source: processed by author

Table 2 presents descriptive statistics for a set of economic variables for the 27 EU member states, reflecting significant disparities in economic and political performance across these countries. The average public debt (*DEBT*) is 59.92% of the GDP with a significant standard deviation, indicating a notable disparity in debt levels among the countries. The average size of the shadow economy (*SE*) is 19.46%, reflecting the scale of informal activities in the economy. The Corruption Perception Index (*CPI*) indicates a wide variation in the level of corruption, with an average of 33.96. Economic growth (*GDP*) shows an average of 2.32%, with significant variation between countries, while the unemployment rate (*U*) averages 8.68%. Inflation (*INF*) has an average of 2.88%, reflecting relative stability. Gross Capital Formation (*GCF*) averages 22.28% of GDP, and population growth (*POP*) shows slight changes with an average of 0.2150%. Finally, trade (*TRD*) records an average of 121.1% of GDP, reflecting varying levels of trade openness among countries.

4. Findings

Table 3 shows the correlation matrixes of the whole EU region, Public debt (*DEBT*) shows a positive correlation with the corruption index (*CPI*) at (0.2026), indicating that higher levels of debt may be associated with higher levels of corruption. In contrast, public debt is negatively correlated with the shadow economy (*SE*) (-0.1276), which means that countries with high debt may rely less on the informal economy. GDP per capita (*GDP*) is negatively correlated with public debt (-0.2549) and the shadow economy (-0.2055), reflecting that higher output may coincide with reduced debt and informal economies. The unemployment rate (*U*) is positively correlated with public debt (0.3203) and the shadow economy (0.2762), indicating that unemployment increases reliance on debt and the informal economy. Inflation (*INF*) shows a positive correlation with GDP (0.1923) and a negative correlation with corruption (-0.1915).

As for trade (*TRD*) and investment (*GCF*), they are negatively correlated with public debt (-0.2723 and -0.4790 respectively), indicating that high debt may limit business and investment activity. Population growth (*POP*) is positively correlated with trade (0.4015) and negatively with GDP (-0.2570). The results reflect a complex interaction between economic and social variables.

This study utilized three modeling approaches for statistical analysis: Pooled OLS, Random Effects Model (REM), and Generalized Method of Moments (GMM). These methods are frequently employed in the analysis of panel data. Each model has limitations; therefore, the panel-corrected standard errors model (PCSE) was selected for all 27 EU countries due to its advantages in addressing potential heteroscedasticity and autocorrelation issues in the data.

The analysis for all 27 European countries commenced with a Pooled OLS utilizing data from 2003 to 2021.

The Breusch-Pagan/Cook-Weinsberg and White tests were employed to evaluate heteroskedasticity in the sampled data. The test yielded a *p-value* of 0.0813 and 0.0000, respectively.

The OLS model is appropriate; however, the data exhibits indications of heteroskedasticity. The multicollinearity assessment, utilizing variance inflation factors, yields an average of 1.42 across all variables, with no individual values exceeding 5. Consequently, the dataset exhibits no multicollinearity.

The Breusch and Pagan Lagrangian test for random effects in the panel yields a *p-value* of 0.0000, indicating that the use of the Random Effects Model (REM) is preferable to Pooled ordinary Least Squares (Pooled OLS) in this sample. REM demonstrates a random variation across countries, with unobserved variables being uncorrelated with the independent variables.

The Hausman test was applied to the data set to evaluate the superior fit between Random Effects Model (REM) and Fixed Effects Model (FEM). The *p-value* indicates that the REM model is a better fit, as it is 0.7044, which exceeds the threshold of 0.05. The data underwent testing with the Wooldridge and Pesaran tests, yielding a *p-value* of 0.0000 (indicating autocorrelation) and 0.404 (indicating no cross-dependency), respectively. Thus, the panel data exhibits evidence of autocorrelation and cross-dependency.

The Ramsey RESET test for robustness indicates a *p-value* of 0.0000, which is less than 0.05. To address the previous issue, panel-corrected standard errors (PCSE) were employed, as the number of observations exceeded the period.

The GMM model was subsequently employed.

According to Table 4, we noticed that in most models, the shadow economy (*SE*) shows a negative impact on public debt, as the shadow economy reduces debt, except for the GMM model which shows a positive impact. This may indicate the indirect effects of the COVID-19 pandemic on increasing governments' reliance on public debt due to the slowdown of the informal economy.

The Corruption Perception Index (*CPI*) shows a positive effect in almost all models, indicating that corruption can increase public debt, as a lack of transparency may lead to the accumulation of debt. In contrast, GDP per capita (*GDP*) is negatively correlated with debt in most models, meaning that countries with higher output tend to reduce public debt. However, the GMM model shows a very significant effect (-1.4845), which may be a result of the negative economic impacts caused by the COVID-19 pandemic.

The unemployment rate (*U*) shows a positive effect in most models, reflecting that an increase in unemployment may lead to an increase in public debt due to rising social expenditures, except in the GMM model where it shows a weak negative effect.

Inflation (*INF*) has a negative impact in all models, meaning that inflation may reduce public debt in some cases due to the erosion of currency value.

Investment (*GCF*) also shows a negative impact on public debt in all models, indicating that increased investments may reduce the need for borrowing.

Population growth (*POP*) shows a complex effect: in some models, it is positively correlated with public debt, while in others, it shows a negative effect, reflecting the economic challenges resulting from an increasing population.

Finally, trade (*TRD*) shows a negative impact in some models, indicating that an increase in trade may lead to a reduction in public debt, while the GMM model shows a positive impact, which may be due to the pandemic's effects on international trade activities.

Table no. 3 Correlation matrix EU27

	DEB	SE	CPI	GDP	U	INF	GCF	POP	TRD
DEBT	1.0000								
SE	-0.1276***	1.0000							
CPI	0.2026***	-0.4090***	1.0000						
GDP	-0.2549***	0.2055***	-0.0772**	1.0000					
U	0.3203***	0.2762***	-0.1434***	-0.0663*	1.0000				
INF	-0.1298***	0.1779***	-0.1915***	0.1923***	-0.1249***	1.0000			
Trd	-0.2723***	-0.1730***	0.2269***	0.1028**	-0.3229***	-0.0240*	1.0000		
Gcf	-0.4790***	0.0664*	-0.2055***	0.2448***	-0.3030***	0.1910***	-0.0313*	1.0000	
Pop	0.0083*	-0.4835***	0.1367***	-0.2570***	-0.3366***	-0.1750***	0.4015***	0.0329*	1.0000

Source: processed by author

Table no 4. P-values indicating the statistical significance of the analyzed variables

Independent variables	Dependent variable DEBT			
	Pooled OLS	REM	PCSE	GMM
SE	-0.5109*** (0.2163)	-1.2576*** (0.2905)	-0.3565* (0.2254)	0.5037*** (0.3271)
CPI	0.1674*** (0.0456)	0.1721*** (0.00229)	0.0628*** (0.0206)	-0.0571*** (0.0197)
GDP	-0.1933* (0.3280)	-0.2510** (0.1256)	-0.3370*** (0.0731)	-1.4845*** (0.0507)
U	1.9941*** (0.3442)	1.3316*** (0.1787)	1.5693*** (0.2853)	-0.4833* (0.2590)
INF	-0.0936* (0.4570)	-0.0426* (0.1771)	-0.1741* (0.1287)	-0.5813*** (0.2235)
GCF	-3.2369*** (0.3274)	-1.3851*** (0.1671)	-0.3733*** (0.1711)	-0.6111*** (0.2318)
POP	4.7864*** (1.7822)	-8.0918*** (0.9082)	-1.5055*** (0.6076)	-9.8855*** (3.2137)
TRD	-0.1755*** (0.0222)	0.0433* (0.0307)	-0.0502*** (0.0253)	0.0836* (0.0457)
_cons	141.09 (10.51)	-95.80 (9.31)	68.83 (7.19)	8.86 (13.61)
Obs.	540	540	540	540
Prop	0.0000	0.0000	0.0000	0.000
F-statistic	46.65	Wald chi2(8) = 821.45	Wald chi2(8)= 149.24	Wald chi2(9)= 17359.36
R-squared	0.4128	0.2022	0.3394	
Sargan test	0.002			
Hansen test	0.114			

Source: processed by author

5. Discussion

The empirical results of our study provide useful insights into the shadow economy and corruption affecting public debt in EU countries, especially in light of the ongoing challenges related to post-pandemic recovery efforts.

Current research showed that the informal economy (SE) has a negative impact on public debt in most models, indicating that reducing the informal economy could lower debt levels. However, the GMM model results show a positive impact, which may reflect the indirect effects of the COVID-19 pandemic on increasing government reliance on public debt due to the slowdown of the informal sector. This observation aligns with the findings of the study by González-Fernández and González-Velasco (2014), which found that the informal economy negatively affects public debt in most cases, although the indirect effects of the pandemic may explain this discrepancy.

The positive relationship between corruption and public debt, as shown in the Corruption Perception Index (CPI), aligns with the study by Kuri et al. (2017), which demonstrated that corruption enhances the impact of government spending and the informal economy on debt accumulation. Herwartz and Thielen (2013) argued that net revenue beneficiary countries in the European Union face weaker incentives to combat informal activities, which exacerbates public debt due to lower revenues.

The negative relationship between GDP per capita and public debt in most models means that countries with higher economic productivity tend to reduce public debt, supported by previous studies such as Ozturk (2021), where higher productivity alleviates financial pressures. Conversely, the unemployment rate (U) shows a positive effect on public debt, which aligns with the findings of Owusu-Nantwi and Owusu-Nantwi (2021), who found that an increase in unemployment leads to higher social expenditures, and consequently, an increase in public debt. The negative impact of inflation (INF) on public debt aligns with the theory that inflation erodes the value of debt, which is also supported by the study by Marcus and Carmen. (2014). Investment (GCF) also shows a negative impact on public debt in all models, which aligns with studies indicating that increased investments reduce the need for borrowing (Arazola et al., 2011).

Moreover, the complex relationship between population growth (POP) and public debt, with varying effects across models, reflects the economic challenges highlighted by Benferatillo et al. (2015), where demographic changes can exacerbate or alleviate financial burdens. Finally, trade (TRD) shows a negative impact on public debt in some models, which aligns with the findings of Dumitrescu et al. (2021), who noted that increased trade can reduce financial pressure. However, the GMM model shows a positive impact, which may be a result of the pandemic's effects on international business activities.

6. Conclusions and policy implication

The empirical results of our study provide useful insights into the shadow economy and corruption affecting public debt in EU countries, especially in light of the ongoing challenges related to post-pandemic recovery efforts. According to our results, we noticed that in most models, the shadow economy (*SE*) shows a negative impact on public debt, as the shadow economy reduces debt, except for the GMM model which shows a positive impact. This may indicate the indirect effects of the COVID-19 pandemic on increasing governments' reliance on public debt due to the slowdown of the informal economy.

The Corruption Perception Index (*CPI*) shows a positive effect in almost all models, indicating that corruption can increase public debt, as a lack of transparency may lead to the accumulation of debt. In contrast, GDP per capita (*GDP*) is negatively correlated with debt in most models, meaning that countries with higher output tend to reduce public debt. However, the GMM model shows a very significant effect, which may be a result of the negative economic impacts caused by the COVID-19 pandemic.

This study presents several recommendations for policymakers in EU countries to tackle the challenges of public debt, particularly in the context of post-COVID-19 recovery.

Efforts must be intensified to diminish the informal economy, as findings suggest that curtailing informal activities could aid in reducing public debt levels. The pandemic has adversely affected the informal economy; however, enhancing policies that promote the transition to the formal economy could potentially decrease the necessity for public borrowing. Furthermore, enhancements in transparency and anti-corruption measures are necessary, as the study findings indicate that corruption contributes to the rise in public debt accumulation. Institutional reforms and improved financial oversight may mitigate this impact.

Economic policies must prioritize the stimulation of economic growth, given the negative correlation between per capita GDP and public debt. Addressing unemployment issues is essential, as they contribute to increased social expenditures and rising debts. This can be achieved through the adoption of policies aimed at enhancing the labor market and stimulating investment.

Maintaining control over inflation levels is crucial, as the study indicates that inflation can mitigate debt by diminishing the value of currency. Also, public investment in productive sectors warrants support, as the study indicates that such investment diminishes the necessity for public

borrowing. Economic policies must consider the impacts of population growth and trade on public debt, emphasizing the enhancement of international trade and the improvement of economic efficiency to tackle the challenges posed by population growth.

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Disrupted Families and Dislocated Fatherhood: Economic Challenges Driving Father Absence in South Africa

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Abstract

Numerous voices of disrupted families are expressing themselves more loudly, and visible consequences are observed in countless broken families. Destructive social issues, such as toxic fatherhood, father absence, and disengaged or unavailable fathers, have resulted in significant challenges within families. Contributing factors include the breakdown of family structures, HIV/AIDS, the COVID-19 pandemic, rising divorce rates, and the increasing complexity of family dynamics. The absence of fathers, often linked to the disintegration of nuclear families, has become a significant concern, particularly in the South African context. Over the past four decades, researchers have made substantial progress, developing and refining conceptual frameworks to clarify human fatherhood.

Key words: disrupted families; dislocated fatherhood; father absence; South Africa

J.E.L. classification: A13, B55, D1, D91, I3

1. Rationale

The family, a fundamental institution in society, plays a crucial role in the survival and well-being of humanity. It is a primary social system through which individuals receive physical, psychological, emotional, and spiritual sustenance. Comprised of individuals connected by blood, marriage, or adoption, the family functions as a cohesive household, where members interact within distinct social roles – such as husband and wife, father and mother, son and daughter, brother and sister – creating a shared culture. Spanning at least three generations, the family evolves, providing stability and strength within society. Families have long been recognized as the core social unit, vital to the political, economic, social, emotional, and religious fabric of life (Kath, 2021, p.17). In South Africa, however, many families are profoundly affected by the absence of father figures (Salami and Okeke, 2018, p.2; Popenoe, 1996, pp.12-13).

2. Introduction

A family is defined as a group of individuals related by blood, marriage, or adoption, typically residing together and sharing emotional and economic bonds. Kath (2021, p.15) states that the term 'family' originates from the Latin word "*familia*," meaning "household" or "household servant," and from "*famulus*," meaning "servant." The term 'family' refers to a distinct social group with a primary objective: to offer intimate care for the development of all families (Kane, 2017, p.10). It serves as the first institution for personal growth, support, and protection (Saikia, 2017, p.445). Parents play a crucial role in instilling norms, values, and character development in their young children, who in turn are expected to respect, love, honor, and obey their parents, as well as support and care for them in their later years (Mayowa, 2021, p.1342). The family constitutes the fundamental unit of society and is seen as the most significant element of a nation (Saikia, 2017, p.445).

In the current service delivery context, families increasingly consist of mothers and their children, while fathers are perceived as irrelevant and insignificant (Fletcher, 2002, p.4). Research shows that children residing with both parents exhibit superior emotional, physical, and academic well-being

(Anderson, 2014, p.378). However, evolving family demographics have led to significant changes in relationships, negatively affecting many families (Anderson, 2014, p.378).

The family significantly impacts a child's development (Felisilda and Torreon, 2020, p.216). Despite being the smallest unit of a social system, it remains the most sensitive and vital component, contributing greatly to society (Felisilda and Torreon, 2020, p.216). The family establishes the spiritual, moral, and psychological foundation for a child's development (Felisilda and Torreon, 2020, p.217). Moreover, it establishes a solid educational foundation for children's spiritual, moral, and psychological development, which is essential for their academic success (Mayowa, 2021, p.1343).

Brody (2020) asserts that familial discord and estrangement can lead to chronic stress, undermining social, mental, and physical well-being. Such discord often arises from religious, political, financial, and existential conflicts and disputes, resulting in long-term physical and emotional suffering. Unresolved conflicts, for example, can lead to chronic stress, which may worsen conditions like anxiety and depression and exacerbate diseases such as heart disease and diabetes, potentially shortening individuals' lifespans (Brody, 2020).

The circumstances of African families in South Africa are unique. Many children are raised in households where both parents cohabit, or where fathers are absent for various reasons. Extended family members – such as grandfathers, uncles, and nephews – often contribute to child-rearing, ensuring the family's overall survival (Mayowa, 2021, p.1342). While African and Euro-American perspectives on families and parenting differ, both are substantial. In the African context, the well-known proverb "It takes a village to raise a child" is often associated with the South African principle of *Ubuntu*, emphasizing that individuals should care for others as they care for themselves. A child's success and well-being are viewed as dependent on the community's support (Tyatya, 2015).

In Sepedi, the phrase "*ngoana ke wa Sechaba*" signifies that a child is a communal responsibility, receiving guidance and education from the community. This community includes the immediate family in which the children are growing and developing. In Nguni, the adage "*intandane enhle ngumakhotwa ngunina*" means that an orphan with a mother is more fortunate than one without, highlighting the significant role of mothers compared to that of fathers (Mabusela, 2014, pp.48-49). A debated claim is that many fatherless children succeed and thrive due to the profound and commendable influence of mothers and grandmothers (Mabusela, 2014, pp.48-49). South African mothers often embody empowerment, strength, assertiveness, resilience, self-reliance, and confidence, nurtured within supportive nuclear and extended families (Magqamfana and Bazana, 2020, p.169). Motherhood is crucial in any family, community, or society, as mothers ensure their children's health, growth, and development, acting as their most effective educators (Leskošek, 2011). However, Mayowa (2021, p.1345) argues that the traditional African family is deteriorating due to the impacts of civilization and modernization, leading to increased marital failures within the African context.

Meyer (2018, p.3) highlights in her research that in 19th-century isiZulu culture, the father (*umnumzana*) was the head of the homestead (*umuzi*) and had the authority to marry multiple wives through the payment of a bride price (*lobolo*). In this context, fatherhood carried both social and economic responsibilities. While the father was the primary role model for his children, other figures such as elders, brothers, uncles, and peers also contributed to the role of fatherhood. In African culture, the roles of father and husband are deeply tied to authority and command respect. Additionally, the father serves as an emotional leader, providing care and support for his family as a provider, and is dedicated to ensuring their safety (Mabusela, 2014, pp.48-49).

3. Theoretical background

This literature review presents a meta-theoretical analysis of disrupted families in South Africa, focusing on the impact of dislocated fatherhood and father absence.

3.1. Disrupted families stem from dislocated fatherhood

What constitutes disrupted families? Over the past 40 years, there has been a significant rise in disrupted families globally, particularly in the United Kingdom (Eddy, Thomson-de Boor and Mphaka, 2013, p.20). Consequently, the UK now has one of the highest rates of disrupted families in the Western world, reaching historically unprecedented levels (Eddy, Thomson-de Boor and Mphaka, 2013, p.20).

A disrupted family is defined as a household where one parent assumes the responsibility for the material, financial, and emotional needs of the family, as well as the caregiving duties of raising children, in the absence of the other parent (Mayowa, 2021, p.1342). Disrupted families are a global phenomenon, impacting vulnerable households in both developed and developing countries (Felisilda and Torreon, 2020, p.217). This trend is particularly notable within African family structures, where modernization and industrialization have contributed to its escalation (Mayowa, 2021, p.1342).

Mayowa (2021, p.1342) argues that disrupted families are often perceived as un-African and treated as exceptional cases or instances of non-acceptance. However, the increasing prevalence of disrupted families has become a growing concern in society (Mayowa, 2021, p.1342). The extended family structure is now expanding rapidly and has surpassed the nuclear family in prevalence (Mayowa, 2021, p.1342). In societies such as Nigeria, disrupted families often go unrecognized or are dismissed as anomalies (Mayowa, 2021, p.1342).

A pertinent inquiry in this context is: What causes familial fragmentation? Families are disrupted by the acceptance of undesirable elements, leading to estrangement and the abandonment of familial responsibilities (Saikia, 2017, p.445). This abandonment marks the beginning of a disjointed family unit, which poses significant societal issues (Saikia, 2017, p.445).

Parental separation or divorce often results from crises such as misunderstandings, mistreatment, and miscommunication. These conflicts can lead to family members leaving the home, abandoning children, and further disrupting the family structure (Saikai, 2017, p.445). This outcome is attributable to illegitimacy, unanticipated pregnancy, and parental mortality (Felisilda and Torreon, 2020, p.217; Mayowa, 2021, p.1343). Disrupted families can also contribute to problematic behaviors, such as drug abuse among youth (Jackson, Usher and O'Brien, 2007, p.321), which further erodes trust within the family and leads to theft, dishonesty, deceit, and unfulfilled promises (Jackson, Usher and O'Brien, 2007, p.325). This dynamic can escalate into abuse and violence, further destabilizing families (Jackson, Usher and O'Brien, 2007, p.325).

Many parents attribute their perceived inadequacies in parenting to themselves (Jackson, Usher and O'Brien, 2007, p.328). Despite the negative perception of parents in society, they significantly influence their children's academic development; however, a disrupted home adversely affects children's academic performance (Felisilda and Torreon, 2020, p.217). Children in disrupted families face significant challenges that complicate their ability to navigate life successfully (Felisilda and Torreon, 2020, p.217). Such family environments disrupt children's lives, leading to detrimental outcomes in their education and emotional well-being (Saikia, 2017, p.445; Mayowa, 2021, p.1342).

Disrupted families have a range of negative effects on children, including emotional instability, academic decline, social relationship difficulties, behavioral issues, and conflicts with parents (Saikai, 2017, pp.447-448). These challenges extend beyond children, affecting parents and society as a whole (Saikai, 2017, pp.446-447). Therefore, the issue of disrupted families should not be underestimated, as it not only impairs children's academic performance but also contributes to delinquency and subpar educational outcomes (Mayowa, 2021, pp.1342-1344).

3.2. Dislocated fatherhood and father absence in South Africa

This discussion addresses critical social issues, including dislocated fatherhood and father absence in South Africa, which have adversely affected families and undermined familial cohesion. Blankenhorn (2001) first characterized dislocated fatherhood as a spiritual issue contributing to father absence, a significant social challenge for families and society. In the South African context, the structural separation of men from their children and families is a legacy of apartheid, colonization, and urbanization, which have dramatically altered family structures and roles over the past century

(Van Onselen, 1976). Colonization forced individuals into wage labor, leading to increased migration from rural to urban areas and prolonged family separations. Apartheid further regulated movement, instituting a migrant labor system that disrupted family life and contributed to the rise of disrupted families (Richter, Chikovore and Makusha, 2010, p.362).

Many men, as husbands and fathers, have succumbed to drug and alcohol abuse, becoming unresponsive to their families (Richter, Chikovore and Makusha, 2010, p.362). Father absence is, therefore, a serious social issue, not unique to South Africa but one of its most pressing challenges (Freeks, 2020, p.2; 2021, p.62). South Africa has the second-highest rate of father absence on the continent (Khan, 2018, p.18; Richter, Chikovore and Makusha, 2010, p.360), which has contributed to rapid changes in family structures and disrupted relationships, particularly regarding father absence (Kesebonye and P' Olak, 2020, p.1).

Father absence remains a pervasive and persistent social issue in post-apartheid South Africa, driven by factors such as evasion of responsibility, household dissolution, divorce, and undisclosed paternity (Albert *et al*, 2021, p.2). This absence is a critical issue in South African society, leading to child neglect and abuse within families (Londt, Kock and John-Lanba, 2017, pp.151-155).

Meyer (2018, p.2) notes the rising prevalence of father absence, which negatively impacts many families. Several factors contribute to this issue, including resource scarcity, unemployment, poverty, the migrant labor system, substance abuse, crime, sexual violence, and unsafe sexual practices (Meyer, 2018, p.4). Research by East *et al* (2020, p.478) demonstrates that father absence correlates with life adversity and detrimental well-being in children, leading to behavioral issues, particularly in children under seven years old (East *et al*, 2020, p.478). This social issue significantly affects the well-being of children and families in terms of economic and social-emotional factors, exerting a causal influence on various aspects of children's welfare (McLanahan, Tach and Schneider, 2013, pp.399-409).

In this context, it is crucial to recognize the growing trend of father absence as a primary factor in the deteriorating well-being of children and a driving force behind many societal issues (Blankenhorn, 2001). Blankenhorn (1998) describes father absence as the most harmful social trend of our generation. Even in historical contexts, such as the reign of the renowned Zulu King Shaka (1787–1828), being fatherless carried significant stigma (Richter, Chikovore and Makusha, 2010, p.361). Father absence often leaves children with feelings of confusion and loss (Richter, Chikovore and Makusha, 2010, p.361). In African tradition, children are esteemed and cherished by the entire family (Richter, Chikovore and Makusha, p.362).

Social issues such as adolescent pregnancy, criminal activity, domestic violence against women, child poverty, and child abuse and neglect are often rooted in father absence, a fundamental factor affecting families (Blankenhorn, 2001). Blankenhorn's 2001 research revealed that approximately 40% of children in the United States live in fatherless homes. In fact, half of all American children experience significant periods of separation from their biological fathers during childhood. Growing up without a father can be profoundly devastating and traumatic for males; however, they have the potential to break this cycle when they become fathers themselves. By being present, accessible, and actively engaged in their children's lives, they can help prevent the continuation of father absence (East *et al*, 2020, p.482).

Despite the critical importance of fatherhood, as highlighted by numerous studies, over 40% of children in the United States are being raised without fathers (Hendry *et al*, 2020, p.19). This poses a serious economic challenge for single-parent households, where mothers, in particular, bear the greatest burden. Blankenhorn describes this situation as historically unprecedented, with a significant number of men estranged from their children and disconnected from the mothers of those children (Blankenhorn, 2001).

Growing up in a household with negligent parents poses significant challenges and risks, especially for males (East *et al*, 2020, p.477). This circumstance is not only regrettable for families but also harmful to children. Children without father figures face significant risks in their lives. Boys are often imbued with violence, hatred, and bitterness, which leads them to perpetrate abuse against women. Conversely, girls often engage in sexual activities and become pregnant prematurely. Unfortunately, many of these girls seek father figures in men whom they perceive to possess their fathers' traits (Blankenhorn, 2001).

3.3. Economic challenges contributing to disrupted families

A longstanding tradition of sociological inquiry has investigated the impacts of divorce and paternal absence on the economic and socio-emotional welfare of offspring across the lifespan. The evidence indicating that paternal absence influences adult economic or familial outcomes is considerably less robust. Thus, the reduction of social safety net assistance and the increase in workplace instability may have exacerbated the economic ramifications of paternal absence, intensifying the adverse effects (McLanahan, Tach and Schneider, 2014, pp.19-20).

Magqamfana and Bazana (2020) identified several factors contributing to father absence in their research, including unemployment, adverse socio-economic conditions, divorce, labor migration, and cultural beliefs. The absence of a father in a child's life is strongly associated with negative psychological outcomes, such as diminished self-esteem, poor academic performance, and insecurity in relationships with the opposite sex. Among black South Africans, fathers are traditionally viewed as economic providers and moral role models. Despite the absence of biological fathers, many young South African women raised in extended families reported resilience, empowerment, assertiveness, and self-reliance, largely due to the support of other family members. As a result, despite facing difficult socio-economic conditions and a lack of partner support, nearly two-thirds of these children developed secure attachments to their mothers.

The presence of a father does not necessarily lead to improved socio-economic conditions, as fathers may be present yet unemployed. Additionally, African fathers, particularly those of African descent, aspire to engage in the socio-educational development of their children; however, they encounter limitations in providing financial and material support due to various cultural and economic factors. The socio-economic factors, namely financial resources, paternal skills, maternal relationships, and paternal race, significantly correlate with the challenges faced by children whose fathers are unable to engage in their socio-educational development. The financial capacity of fathers may influence their ability to fulfil their anticipated roles (Salami and Okeke, 2018, pp.3-5).

In the research conducted by Rantho, Matlakala, and Maluleke (2022), it is highlighted that numerous scholars have concentrated on elucidating the impact of South African history and the apartheid regime on the economic challenges faced by citizens. The atypical environmental conditions have presented difficulties for many families, compelling them to seek equilibrium in an environment that does not foster familial stability. Consequently, these households have disintegrated, resulting in an increase in absent fathers, which has adversely affected numerous father-child relationships and instilled in children the perception that fathers are merely financial providers rather than supportive figures. Fathers were expected to reduce their visits to their children in order to conserve finances, thereby hindering their ability to provide emotional and physical support, which consequently rendered mothers the primary support networks. Notwithstanding the economic obstacles that impede paternal engagement, many fathers still aspire to be active in their children's lives and to cultivate a connection with them.

In the analysis by Freeks (2024, p.74), father absence is identified as a significant and pressing concern that is catalyzing swift socio-economic changes throughout Africa, with South Africa exhibiting particularly pronounced impacts. Moreover, a substantial proportion of families in South Africa are led by single mothers, with the primary factors contributing to the socio-economic challenges of single parenting linked to the negative social consequences of fatherhood and paternal absence.

In summary, the role of a father encompasses not only the joys and benefits associated with children but also leads to adverse psychological repercussions. Fatherhood is simultaneously gratifying and detrimental (Waldvogel and Ehlert, 2016, p.2). It is important to acknowledge that limited fatherhood, as seen in disrupted families, results in guilt, feelings of inadequacy, and role strain (Waldvogel and Ehlert, 2016, p.2).

4. Research methodology

The methodology used in this paper provided a strategic framework to achieve the research objectives. According to Vyhmeister (2008, p.38), the methodology serves as the process through which the articulated objective is accomplished. It clarifies the researcher's approach to collecting,

analyzing, and evaluating data to address the research question or hypothesis. This study employed a descriptive literature review to explore the phenomenon of dislocated fatherhood and father absence, along with the associated economic challenges and their impact on families. A wide range of sources, including books, journal articles, academic papers, and literature reviews, were analyzed to identify trends, events, and scenarios relevant to the topic. The literature review encompassed both national and international scholarly works. Multiple academic databases, such as ATLAS, EBSCOhost, NEXUS, SCOPUS, ISI, and ISAP from North-West University (NWU) in South Africa, were utilized to gather data. The research question was: "What are the detrimental consequences of dislocated fatherhood, father absence, and the economic challenges for families in South Africa?"

5. Findings

Family stability serves as a foundational element for children's success and advancement in life. However, when parents divorce, many children lose this stability, resulting in the loss of critical aspects of their childhood, with effects that can persist throughout their lives (Felisilda and Torreón, 2020, p.17). A contributing factor to disrupted families, particularly in the African context, is the cultural shift towards cohabiting families, which makes them more vulnerable to instability (Mayowa, 2021, p.1342; Eddy, Thomson-de Boer and Mphaka, 2013, p.14). This literature review identifies six key findings related to disrupted families, focusing on dislocated fatherhood, father absence, and the economic challenges faced by families in South Africa:

5.1. Dissolution of marriage

Within the scope of this paper, the primary detrimental factor contributing to disrupted families is divorce. Consequently, it is essential to acknowledge that divorce serves as a significant causal factor for many families in South Africa. The impact of divorce on the family unit is profound, as it is the leading cause of fractured familial relationships. Common disputes between spouses encompass financial issues, adolescent pregnancy, sexual misunderstandings, early marriage, health concerns, education, and a range of other factors. The dissolution of marriage may result in one or both parents vacating the household, and the absence of a parent can negatively affect the family's overall functioning. Divorce has far-reaching consequences for children, undermining their competence in various aspects of life, including education, emotional well-being, familial relationships, and future earning potential.

5.2. Death

The loss of a family member diminishes familial cohesion, with the death of a mother being more devastating than that of a father in early childhood. Mothers typically play a crucial role in nurturing children during their formative years. However, as children grow, the absence of a father tends to be more detrimental, especially for boys. In such cases, mothers often struggle to balance the dual responsibilities of earning a livelihood and managing the household, which can affect their ability to provide adequate care for their children.

5.3. Misunderstandings

Family issues often arise from misunderstandings among household members, which can be destructive and harmful. These misunderstandings are frequently fueled by factors such as alcohol misuse, drug abuse, domestic violence, and misconduct within the family.

5.4. Administrative failures

Administrative failures, particularly ineffective family management or leadership, contribute to disrupted families.

5.5. Influence of parents or friends

Family fragmentation has often resulted from negative external influences, including disparagement.

5.6. Violence

Domestic violence is unequivocally unacceptable due to its harmful impact on children's development, behavior, academic performance, and long-term health.

6. Conclusion

The family is fundamental to any human group, playing a vital role in the comprehensive development of individuals and driving societal transformation. It is within families that new generations are nurtured, and care and affection are extended to the older generation, fostering education, mental health, and empowerment for all. The family is also a space where members should experience security, intimacy, and the freedom to express their true selves, while simultaneously contributing to the well-being of the family unit. At the core of family life is God, with everything revolving around God's divine plan and will. Life derives its meaning in relation to God, and its purpose is fulfilled through interpersonal relationships, which are best practiced within the family. A Christian family that prays together remains united, and while this perspective is central to Christian families, it is also acknowledged and valued by various other religious traditions (Kath, 2021, p.16).

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Hidroelectrica: A Case Study in Public Sector Governance During Crisis

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Abstract

This paper maintains its focus on examining Hidroelectrica, Romania's leading energy producer, as a case study to enhance understanding of governance dynamics in the public sector. Corporate governance has a significant role in ensuring sustainable development, resilience, and accountability. The study examines the company's responses to three significant crises: the Great Recession, the insolvency from 2012, and the COVID-19 pandemic. Analyzing governance structures and financial indicators, the paper shows how robust frameworks contribute to adaptation and resilience. The paper also addresses challenges like gender diversity. The findings emphasize the importance of transparency, inclusivity, and proactive governance in achieving long-term stability and growth.

Key words: corporate governance, crises, financial indicators, board diversity

J.E.L. classification: G3, H12

1. Introduction

Corporate governance constitutes a cornerstone regarding the sustainable development of an organization, especially for the state-owned enterprises that operate in complex environments and politics. Hidroelectrica, the leading producer of electrical energy in Romania, is a suitable example for a better understanding of the challenges and opportunities in public sector governance.

In public sector entities like Hidroelectrica, corporate governance plays a crucial role in directing and controlling organizations. Effective governance is essential for ensuring accountability, transparency, and the alignment of interests among various stakeholders, including government officials and citizens. Historical events and financial crises have influenced the evolution of corporate governance, prompting a continuous reassessment of governance practices.

Hidroelectrica has encountered considerable difficulties amid crises like the Great Recession and the COVID-19 pandemic. The incidents evaluated the company's governance frameworks and underscored the imperative for resilience and adaptation in business operations. As governments globally faced unparalleled challenges during the pandemic, efficient governance processes became essential for sustaining transparency and stakeholder confidence.

Despite such obstacles, Hidroelectrica has established itself as a leader in the energy market, underscoring the significance of effective governance processes. Essential governance components, like the Supervisory Board's involvement in risk management and the Directorate's control of operations, have facilitated the company's recovery and ongoing expansion.

This paper aims to analyze the corporate governance practices of Hidroelectrica by exploring strategic responses to crises. The study emphasizes the understanding of how robust governance frameworks contribute to financial performance and sustainable development in the context of public sector entities that operate in dynamic environments.

The paper hypothesizes that a stable corporate governance structure, characterized by transparency and inclusivity, can significantly enhance the capacity of public sector enterprises to adapt to crises, ensure accountability, and achieve long-term financial and operational stability.

2. Literature review

The evolution of corporate governance over the years is a result of multiple factors, past situations, and crises worldwide. The literature shows a mixture of governance structures, economic performance, and the regulatory environment, particularly during financial crisis periods. This section follows an overview of the evolution of the corporate governance concept through history and during financial crisis.

Corporate governance encompasses the frameworks and procedures used for decision-making, accountability, control, and conduct at the highest levels of an organization (Tricker, 2015). The term "corporate governance" is relatively new, despite the existence of its concept long before it was coined. The United States of America first used it in 1970, and since then, it has emerged as a highly contested field of study. The concept of corporate governance first surfaced with the emergence of the first joint-stock companies, like Dutch East India and Hudson's Bay in the 16th and 17th centuries. These companies faced conflicts between managers and shareholders, leading to the need for improved governance structures to safeguard the interests of both parties (Gevurtz, 2004). Later, in the 18th century, Adam Smith, the father of the modern economy, highlighted the different interests that appear between the owners and managers of a company. He said that managers, as stewards of others' money, would not handle it as cautiously as they would their own, pointing to fundamental governance issues. The Industrial Revolution from the 19th century brought with it a growing economy and the need for external capital. Great Britain introduced the Limited Liability Act in 1855, a measure through which shareholders' liability in case of bankruptcy was limited. (Jovanovic & Grjic, 2016)

After World War II ended, the United States experienced significant economic growth, leading to a separation between the idea of control and ownership. Berle and Means (2017) identified this separation as an important element of corporate governance. The Great Depression of 1929 exposed some governance issues, prompting some major reforms from the Securities and Exchange Commission (SEC) (Wells, 2010). The 80s were marked by hostile takeovers that shifted the focus to shareholder rights and board responsibilities, emphasizing the need for better control of management practices. The Cadbury Report in 1992 was a major act that introduced a code for good practices in terms of corporate governance, and it focused on the independence of directors and the separation of the CEO and chairperson roles (Cheffins, 2015). The early 2000s were full of scandals such as Enron or Worldcom that led to the adoption of the Sarbanes-Oxley Act in 2002 in the U.S., aimed to improve the level of transparency and establish new standards for corporate boards. After the problems with the 2008 financial crisis, a new act, the Dodd-Frank one, was introduced in 2010 to strengthen corporate governance and protect shareholders (Mahajan et al, 2023). The last few years were marked by the appearance of the OECD, an organization that is concerned with corporate governance principles, and its focus stays on different problems such as transparency, diversity, corporate social responsibility (CSR), and environmental, social, and governance factors.

One of the most important events that tested corporate governance was the financial crisis from 2007–2008. Numerous individuals have drawn comparisons between it and the Great Depression. Krugman considered this crisis milder than the one from the the 1930s, but others, Eichengreen and O'Rourke, thought it was as bad as the Great Depression if not worse from a wider point of view (Krugman, 2009; Eichengreen et al. 2010). The 2008 financial crisis acted as a trigger for a global reassessment of corporate governance frameworks. It exposed the weaknesses in existing governance systems, particularly in their ability to curb excessive risk-taking and enforce accountability within financial institutions (Li, 2009). Research has demonstrated that shortcomings in corporate governance were major contributors to the financial crisis, as many organizations lacked adequate oversight mechanisms (Sharfman et al., 2010). This prompted a renewed emphasis on the importance of strong governance frameworks capable of enduring economic shocks.

Corporate governance in the public sector is notably complex because public managers must balance multiple objectives. Unlike their private sector counterparts, who mainly prioritize profit maximization, public sector managers are accountable to a diverse range of stakeholders, including government officials and citizens. This complexity can result in inefficiencies and challenges in the decision-making process. A clear example is the governance of state-owned enterprises (SOEs),

where practices must align with broader social goals rather than focusing solely on financial performance (Scrimgeour & Duppati, 2013).

Another significant event that sparked a global crisis was the COVID-19 health crisis. Not only were the health systems collapsing, but the global economy also suffered greatly. This new crisis has significantly impacted corporate governance practices. Governments faced unprecedented challenges, so the need for effective corporate governance mechanisms was a must to ensure optimal levels of transparency and accountability for public or private companies. The pandemic exposed some vulnerabilities in corporate governance and emphasized the significance of implementing effective strategies to effectively manage resources and navigate through the crisis.

One of the most important elements during the health crisis regarding corporate governance was resilience and adaptability. According to Ding et al. (2021) and Steinhauser & Čukanová (2018), elements such as managerial entrenchment and board composition within corporate governance structures were demonstrated to be influential on the resilience of organizations to the pandemic. Their findings showed that companies having a strong corporate governance framework had more chances to face the difficulties brought by COVID-19. Similarly, Musa et al.(2022) and Howard & Seth-Purdie (2005) emphasize that the true value of corporate governance principles becomes apparent during economic shocks, as they are essential for maintaining financial stability and performance.

The pandemic highlighted the critical need for greater transparency in public sector governance. According to Howard & Seth-Purdie (2005), the increased demand for transparency and collaborative actions against corruption during the crisis led to a reassessment of public sector governance standards. The authors point out that the governance shortcomings in the public sector, when compared to the private sector, underscore the need for well-defined standards to ensure accountability and the proper application of governance principles. This emphasis on transparency is consistent with broader discussions in the literature calling for stronger governance frameworks to build public trust and foster stakeholder involvement during times of crisis.

The COVID-19 pandemic emphasized the importance of digital transformation in public sector governance. Palos-Sánchez et al. (2023) and Ryan & Ng (2000) discuss how local governments were forced to embrace digital innovations to address the challenges posed by the crisis, aligning their efforts with the United Nations' Sustainable Development Goals (SDGs). The authors argue that this rapid digital adoption can boost citizen engagement and improve service delivery, showcasing how governance frameworks can adapt to external pressures. The transition to digital governance not only enhances communication with citizens but also fosters greater transparency and accountability in decision-making processes.

In conclusion, the COVID-19 pandemic has been a catalyst for major changes in corporate governance within the public sector. The crisis has underscored the importance of developing resilient governance frameworks that emphasize transparency, adaptability, and active stakeholder engagement. As governments continue to confront the ongoing challenges of the pandemic, the insights gained will play a crucial role in shaping future governance practices, strengthening the ability of public institutions to respond more effectively to crises.

3. Research methodology

The analysis is based on data extracted from the company's official reports, financial statements, and governance documents, alongside insights from existing literature on corporate governance. We evaluated key aspects such as governance structures, financial performance, and strategic responses during crises (e.g., the 2008 Great Recession, 2012 insolvency, and the COVID-19 pandemic) to understand how Hidroelectrica adapted to challenges and implemented governance reforms.

4. Findings

4.1 About Hidroelectrica and the energy market in Romania

Hidroelectrica is the main producer of electrical energy in Romania, an important actor in the energetic sector of the European Union, and an essential supplier of technological services within the

National Energy System. Founded in 2000, the company has emerged as the primary energy producer and supplier in Romania, a testament to its experience, trust, and flexibility over the years. The company has and operates 187 hydropower plants and micro-hydroelectric plants.

Hidroelectrica has committed to producing energy exclusively from renewable sources and developing technological and operational standards in the field since its inception. The company is both a wholesale supplier and a direct distributor to domestic and industrial consumers in various economic sectors. Building on synergies between its hydro and wind portfolios, Hidroelectrica is exploring diversification toward other renewable sources, such as solar energy, thereby reinforcing its contribution to the energy transition.

Hidroelectrica has a very well-defined mission, which is to generate value through the production and commercialization of electrical energy in a responsible and committed way to the environment and community, ensuring quality and performance. Regarding the vision, the company wants to consolidate its leadership position in the process of producing electrical energy and providing technological services with an accent on sustainable development. Hidroelectrica's fundamental values include performance, integrity, social responsibility, teamwork, and creativity.

The company capitalizes on the wholesale trading markets and the retail market (through the activity of supply to final consumers) for the electrical energy it produces.

Fondul Proprietatea S.A. organized the initial public offer (IPO) for Hidroelectrica shares, representing up to 19.94% of the total shares of the company, from 23 June to 4 July 2023. This offer attracted a record number of over 50,000 purchase orders. Fondul Proprietatea exercised its option of overallocation in favor of intermediary banks, resulting in the sale of the entire package of 89,708,177 shares owned by the fund on the Bucharest Stock Exchange. Some BVB indices, specifically the BET index (local market benchmark) and BET-NG (sectoral index showing the evolution of companies listed on the BSE and operating in the energy sector), have included the shares of Hidroelectrica since July 12, 2023. The Early Inclusion (MSCI) and Fast Entry (FTSE Russell) indices have also included them.

Romania liberalizes the electricity market, enabling consumers to select their preferred supplier through negotiated tariffs. The group supplies energy to both industrial and domestic consumers, generating revenue from the sale of active energy and from passed-on costs such as green certificates, transmission, distribution, and other fixed charges. In 2023, Romania marked its energy market with the introduction of the MACEE mechanism, where energy producers sell 80% of the estimated annual energy at a fixed price of 450 RON/MWh to OPCOM, ensuring the stability and quality of the system.

In 2023, inflation in Romania continued to decline, reaching 9.7%, due to the reduction in fuel and food prices. However, geopolitical tensions in the Middle East and risks associated with energy transit have amplified global uncertainties, and the green transition and climate measures can generate inflationary pressures. Hidroelectrica maintains its prudent strategy by investing only in cost-effective renewable projects in the context of an uncertain legislative framework. At the same time, legislative changes and competition in the labor market affect the company's ability to attract qualified personnel, while priorities remain revenue predictability and operational stability. (Annual report, 2023)

4.2 Hidroelectrica in times of crises

Hidroelectrica faced three major crises: the Great Recession from 2008, insolvency, and the COVID-19 crisis, but succeeded in getting through every one of them.

I. *The Great Recession.* The financial crisis that started in 2007-2008 had a considerable impact on the global economy and, of course, on the energy sector in Romania. It affected the demand for electrical energy, and it led to big fluctuations in prices of electrical energy. The decline in energy demand from the industrial sector, the primary consumer, impacted Hidroelectrica during this crisis. For Hidroelectrica, this period meant the downfall of revenues because the company reported significant loss due to unfavorable contracts and increased costs. At the same time, adapting to new market conditions was necessary, which required internal restructuring and a re-evaluation of trade strategies.

II. *The insolvency period.* The insolvency period started in 2012, a critical moment for the company. Bilateral contracts with energy traders, considered damaging by the judicial administrator, EURO INSOL, largely contributed to Hidroelectrica's insolvency. In its report, EURO INSOL identified nine main factors that contributed to the deterioration of the company's financial indicators and led to insolvency:

Significant investments with minimal energy advantage failed to produce a sufficient cost-benefit ratio.

Disadvantageous contracts for the purchase of electricity from other producers have financially burdened the company.

Energy sales on the regulated market resulted in losses because the prices did not accurately reflect the production costs.

Hydroelectric power plant equipment maintenance and repair come at a high cost. Excessive labour costs are influenced by collective labour contract conditions.

The cost of wastewater increased fourfold, significantly impacting operational costs.

The drought led to a decrease in revenues, which impacted the production of hydropower.

Poor management is characterized by inefficient strategic and operational decisions. (Insolvency Report, 2012)

III. *The COVID-19 crisis.* The pandemic had a significant impact on the energy market, reducing demand from the industrial sector and raising economic uncertainty. Hidroelectrica demonstrated resilience due to its relatively low operational costs and sound financial structure. In addition, growing interest in renewable energy, a key segment for Hidroelectrica, was an opportunity during this period, preparing the company for new strategic investments in green technologies. (Annual Report, 2020, 2021)

4.3 Board composition

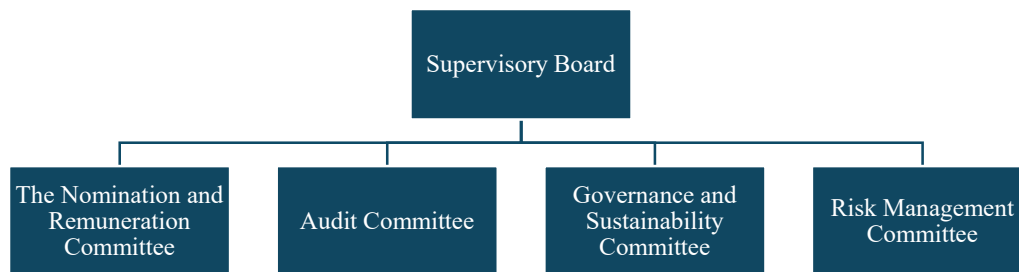
The board of directors, under the supervision of the supervisory board, administers Hidroelectrica in a dual system.

The Directorate is solely responsible for the management of the company. The Supervisory Board nominates 5 members for a term of 4 years, with the possibility of re-election for successive terms of office. The applicable legal provisions guide the selection of the directorate's members.

The supervisory board has 7 members who cannot be directors as well as company employees. They are non-executive members, named according to the legislation of corporate governance in Romania. The OGM names these members, and their mandate is valid for 4 years.

The supervisory board of Hidroelectrica comprises several committees, each with distinct responsibilities, including the Nomination and Remuneration Committee, Audit Committee, Risk Management Committee, and Governance and Sustainability Committee. As presented in Figure No. 1, the supervisory board members form all these committees following their organization and functioning regulations.

Figure no.1. The structure of the Supervisory Board



Source: own processing from Hidroelectrica annual report – 2023

Table no. 1 Board directors and supervisory board – details about members

Mandate period (2023-2027)	Number of members	Independence of members	Gender	Experience	Professional background
Supervisory Board	7		2 women, 5 men	Vast experience	Law, economics, management
Board of directors	5		All men	Vast experience	Corporate governance, engineering, economics

Source: own processing based on information from Hidroelectrica annual reports

Upon analyzing the composition of the board of directors and supervisory board, we observed the following aspects, which are presented in Table No 2. The board comprises seven members, including two women, with extensive knowledge in law, economics, and management. This diversity in professional background adds value to decision-making. Experienced professionals, all male, specialize in corporate governance, engineering, and economics. While professional expertise is strong, gender imbalance, especially in the Board of Directors, is a notable gap.

Table no.2 Hidroelectrica's shareholder structure

Shareholder	Shares	Percentage
Romanian state through the Ministry of Energy	360.094.390	80,0561%
Juridical persons	73.379.328	16,3137%
Natural persons	16.328.849	3,6302%
TOTAL	449.802.567	100%

Source: own processing from Hidroelectrica annual report – 2023

Regarding the shareholding structure (Tabel no.2), the majority is owned by the Romanian State through the Ministry of Energy (80%), and the remaining 20% is divided between legal entities (~16%) and individuals (~4%).

4.4 Financial indicators of Hidroelectrica

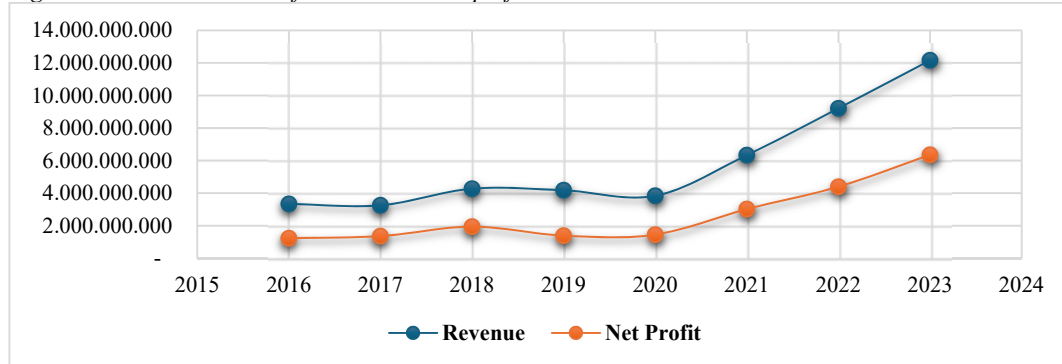
Some of the most relevant financial indicators were included to provide a brief analysis of Hidroelectrica's economic situation: Revenue, EBITDA, Net Profit, Net Profit Margin, ROA, ROE, Current ratio, Debt-to-equity ratio, Total assets, Shareholders' equity, Current assets, Current liabilities, and Total liabilities. These indicators are presented between 2016 and 2023.

Table no. 3 Hidroelectrica's financial indicators

Indicator	2016	2017	2018	2019	2020	2021	2022	2023
Revenue	3.338.028.782	3.253.651.389	4.273.132.730	4.177.208.541	3.839.909.000	6.335.390.000	9.212.111.226	12.159.373.344
EBITDA	2.243.000.000	2.259.000.000	3.126.630.879	2.934.315.752	2.711.130.789	4.230.000.000	5.664.000.000	7.996.000.000
Net Profit	1.227.666.438	1.359.687.718	1.939.277.740	1.386.536.518	1.451.575.383	3.019.511.168	4.394.378.205	6.352.326.530
Total assets	18.849.291.724	18.411.888.504	18.615.479.926	17.292.428.655	16.659.559.030	22.686.265.230	25.403.744.789	29.064.693.547
Shareholders' equity	17.845.188.937	17.514.933.199	16.559.525.447	15.095.367.736	14.527.051.579	19.152.906.335	21.626.313.231	25.037.000.997
Current assets	2.397.197.721	2.439.502.918	3.321.125.451	2.376.704.929	2.501.558.339	4.338.090.005	5.201.092.548	7.997.855.142
Current liabilities	393.620.730	353.542.166	679.219.461	579.697.359	556.031.479	924.713.057	989.429.483	1.071.719.905
Total liabilities	623.633.803	483.225.420	2.055.954.479	2.197.060.919	2.132.507.451	3.533.358.895	3.777.431.558	4.027.692.550
Net Profit Margin	0,37	0,42	0,45	0,33	0,38	0,48	0,48	0,52
ROA	0,07	0,07	0,1	0,08	0,09	0,13	0,17	0,22
ROE	0,07	0,08	0,12	0,09	0,1	0,16	0,2	0,25
Current ratio	6,09	6,9	4,89	4,1	4,5	4,69	5,26	7,46
Debt-to-equity ratio	0,03	0,03	0,12	0,15	0,15	0,18	0,17	0,16

Source: own processing from Hidroelectrica's financial statements 2016-2023

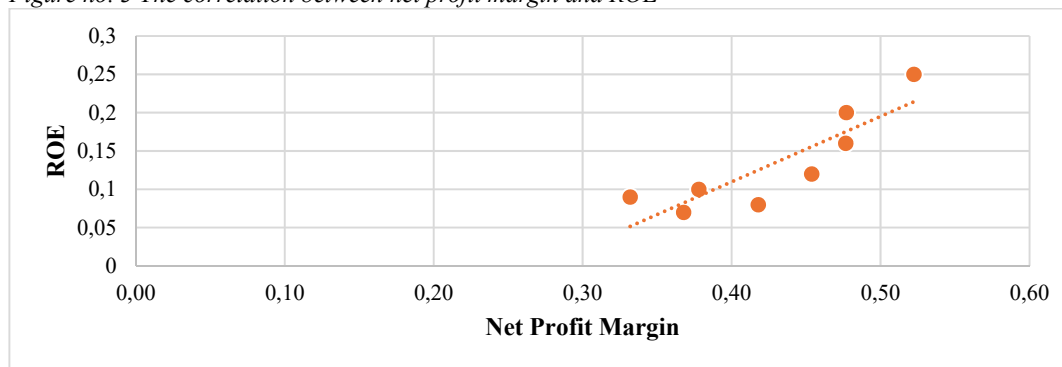
Figure no. 2 The evolution of revenue and net profit between 2016-2023



Source: own processing

In figure no. 2 there is presented the evolution of revenue and net profit between 2016-2023. It can be observed the fact that these two indicators have similar trend lines. The highest values in both cases were registered in 2023. If the values of revenue and net profit oscillate between 2016-2020, it can be easily observed the fact that from 2021 until 2023 there is an ascending evolution of these two indicators. The data reflect effective recovery and growth post-COVID-19. Fluctuations in earlier years point to external vulnerabilities such as market and regulatory changes.

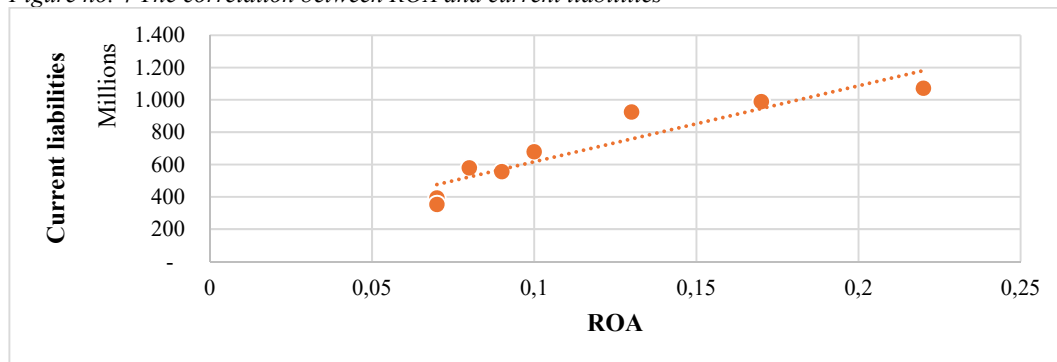
Figure no. 3 The correlation between net profit margin and ROE



Source: own processing

Figure no. 3 likely demonstrates a positive correlation: as net profit margins increase, the return on equity also improves. This indicates that profitability directly contributes to shareholder returns, showcasing effective financial performance. Strong governance likely supports this relationship by ensuring disciplined financial management and operational efficiency.

Figure no. 4 The correlation between ROA and current liabilities



Source: own processing

Figure no. 4 illustrates how current liabilities impact return on assets. A balanced trend suggests that liabilities are managed well without significantly burdening the asset base. Effective asset utilization and liability management demonstrate operational soundness, essential for maintaining liquidity and solvency.

5. Conclusions

This paper highlights the importance of having effective corporate governance in public sector entities, especially during times of crisis. The analysis emphasizes the robust corporate governance framework of Hidroelectrica, which faced significant challenges during the financial crisis of 2008, the insolvency crisis of 2012, and the pandemic crisis. These events highlighted the imperative for resilience and adaptability in governance processes, illustrating that businesses with robust governance frameworks are more effectively equipped to address external shocks.

The examination of financial metrics from 2016 to 2023 highlights the efficacy of these governance strategies, as evidenced by sustained enhancements in sales, net profit, and return on equity following 2020. These trends demonstrate Hidroelectrica's capacity to adjust to external demands while preserving financial stability and operational efficiency. Nonetheless, obstacles such as insufficient gender diversity in leadership positions and restricted stakeholder diversity persist as substantial issues. Rectifying these deficiencies could improve decision-making and align the organization with global corporate governance standards.

Hidroelectrica and analogous public enterprises must advance their governance structures. Hidroelectrica's history as a state-owned firm highlights the necessity of reconciling public accountability with market efficiency. The company's dedication to renewable energy and sustainable practices enables it to significantly contribute to Romania's energy transition and global sustainability goals. Future investments in governance changes, stakeholder inclusion, and creative energy solutions will be essential for addressing upcoming crises and sustaining leadership in the renewable energy sector. The insights gained from Hidroelectrica's crisis experiences can guide best practices in public sector governance globally, ensuring these entities continue to provide societal value despite challenges.

This paper's limitation is related to the focus on studying a single company, which, while offering more in-depth insight, may not fully capture the broader complexities of public sector governance across different economic contexts. Further research should explore comparative analyses of state-owned enterprises from other countries for a better understanding of the interplay between governance practices and resilience in diverse environments.

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Bridging the Gender Gap: Exploring the Challenges that Women Face in Entrepreneurship

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Abstract

The cultural, structural, and financial obstacles that prevent women from participating and succeeding in business are the main emphasis of this study on the gender gap in entrepreneurship. It investigates gender-specific reasons for starting a business as well as the biases and stereotypes that undermine women's credibility as entrepreneurs through a critical review of recent literature. Cultural biases, societal norms around work-life balance, and restricted access to outside finance are some of the main obstacles. These obstacles limit the growth of female entrepreneurs' businesses and significantly affect their participation. The study concludes that promoting a more equitable and inclusive entrepreneurial environment requires focused interventions, such as better financial access and eliminating gender stereotypes.

Key words: Entrepreneurship, Gender gap, Women entrepreneurship

J.E.L. classification: I25, J16, L26, M13, O15, P46

1. Introduction

Entrepreneurship is essential for economic growth and innovation. However, some members of the society face difficulty when starting their own business, such as females. According to the previous reports and literature, a prominent gender gap exists in entrepreneurship due to various cultural and social limitations that women face in the present society. Regardless of taking several initiatives to foster inclusivity, males still outnumber females in entrepreneurial ventures across the globe in major industries. This huge gender disparity in business context is not only a reflection of personal choices and priorities but also a by-product of deep-rooted societal and cultural beliefs and norms and rituals that disadvantage females.

Previous research also highlights that female entrepreneurs encounter more obstacles, limited access to external financing, and comparatively less business opportunities. All these hurdles are restricting females' equal participation in entrepreneurial activities (Vracheva and Stoyneva, 2020). Furthermore, they also prevent them from growing their business to a larger scale.

This gender gap is a result of numerous external and internal factors. Externally, females face gender biases and stereotypes from the society, which makes it more challenging for them to start a business. Furthermore, these stereotypes influence females' entrepreneurial intentions, motivation, and behavior. Internally, women are challenged by self-doubt and low confidence. Hence, it is imperative to understand entrepreneurial intention to address the existing gender gap that prevails in business context. Previous papers also reveal that females usually have lower entrepreneurial intentions than males because of the less risk-taking behavior.

Females are still lagging behind because of all the aforementioned reasons, and policymakers should take necessary initiatives to address this issue and fill the gender gap. Bridging the gender gap is crucial because of the associated advantages that should not be overlooked, such as improved

business, economic growth, and innovation. As per the existing literature, firms that have more gender diversity tend to outperform their competitors. However, there are still some researchers that oppose the aforementioned statements.

The main purpose of this paper is to throw light on this serious issue and encourage the concerned authorities to take appropriate initiatives to bridge the prominent gender gap that exists in entrepreneurship. By reviewing the literature, the present article intends to offer a comprehensive understanding of the gender gap issue that still prevails in entrepreneurship.

Based on the above arguments, the research questions that we attempt to answer in this paper are as follows:

1. Do cultural prejudices and gender-specific motives affect women's entrepreneurial goals, behavior, and even access to outside funding?
2. What are the main causes of the gender gap in entrepreneurship?

2. Theoretical background

Previous researchers (Jafari-Sadeghi, 2020) made several attempts to define the term entrepreneurship. For some scholars, it is the personal need to self-achieve and the willingness to be self-employed, while for others it is "any attempt" made in the direction of starting a new business. In the last decade, a huge number of research papers (Ughetto et al., 2020) highlighted the significance of women entrepreneurship and the benefits driven by females' involvement in businesses, especially when they are employed in a managerial position. According to Morazzoni and Sy (2022), improving productivity, creating work opportunities, and innovation are some of the most common advantages provided by entrepreneurship. Cardella et al. (2020) also support the aforementioned statement and affirm that women entrepreneurship has gained a lot of attention from researchers in the past few years all over the world.

Entrepreneurship is beneficial for the economic health of our society because it contributes to improving the quality of life equally for both genders (Jafari-Sadeghi, 2020). Furthermore, Jafari-Sadeghi (2020) also claims that women are getting more involved in entrepreneurial activities because of the recent progressions in our society. Cardella et al. (2020) also agree and assert that the increasing number of females participating in entrepreneurship is positively impacting economic development by promoting social inclusion and minimizing poverty. Regardless of all these benefits, the number of female entrepreneurs is still lower than that of male entrepreneurs (Cardella et al., 2020). This gap between genders can be explained by the roles that males and females individually play in our society as well as the stereotypes attached. Jafari-Sadeghi (2020) also mentions in one of his studies that in business context, women are still lagging behind.

The above statements are true for the Asian countries as well. As per the previous research (Franzke et al., 2022) conducted among Asians, it is less likely that females will start their own company in comparison to their male counterparts. But female entrepreneurship plays a major role in economic growth in Asian countries, and this can be argued based on the latest increase in the number of females starting their own businesses in this region due to recent progression. Hence, proper measures should be taken to fill this gender gap that currently exists in the entrepreneurial context.

Franzke et al. (2022) claim that even though women entrepreneurs are disadvantaged in several ways, in some cases, they still manage to break the stereotypes by going against the social norms. Due to deep-rooted gender bias and stereotypes, cultural norms, as well as social judgments, women are still lagging behind in the race of being an entrepreneur. Moreover, male-dominated societies generally constrain females to start a new venture (Ughetto et al., 2020). Therefore, there is a strong need in the society to understand the reasons for this gap and empower women to start their own companies. This step is not only beneficial for a particular gender but also for the whole society.

3. Research methodology

A thorough literature analysis was used as the research methodology in this work since it was deemed suitable for examining the corpus of existing research on gender differences in entrepreneurship. The gender gap, entrepreneurial intentions, motives, and societal hurdles that women encounter in the context of entrepreneurship can all be thoroughly examined using this method. Because it synthesizes findings from multiple sources and provides a more comprehensive understanding of the ways in which cultural, structural, and economic issues impact women's entrepreneurial activity, a literature review is especially appropriate for this research. This method offers a more nuanced understanding of the gender-related aspects of entrepreneurship by identifying recurrent gaps and contradictions in the present discourse by pulling from a variety of research.

The literature review concentrated on research papers published between the years 2020 and 2024 to guarantee the findings' credibility and recency. Given current global changes in gender roles and entrepreneurship, this timeline was chosen to represent the most recent discoveries. Google Scholar served as the main search engine because of its extensive library of scholarly publications and peer-reviewed research. A targeted review of the literature was made possible by the use of the keyword "female male ratio difference in entrepreneurship" to find research that particularly addressed gender differences in entrepreneurship. In addition to proposing opportunities for future study and policy interventions, this approach allowed the authors to incorporate recent results on the difficulties women experience, including work-life balance, societal biases, and access to external funding.

4. Findings

4.1 Entrepreneurial intentions

It is interesting to note that regardless of the vast literature on this topic, researchers know little about the mechanisms through which some members of the society get discouraged or encouraged to start up their own company (Liñán et al., 2022). In the past, several models were used to explain the entrepreneurial behavior and its prediction. However, the intention-based models are the most-discussed in the last few years. Similarly, the theory of planned behavior represents one such model that is used to understand, predict, as well as change human social behavior. Such models suggest that entrepreneurship is not an instinctive act, rather a planned and voluntary behavior that argues that people can gain entrepreneurial intention over a period of time. Furthermore, an individual's intention to get involved in a certain field or activity depends on one's attitude, principles, norms, etc. Hence, Vamvaka et al. (2020) argue that perceived behavioral control is directly influenced by an individual's attitudes as well as subjective norms regarding the behavior. At last, when some opportunities arrive, humans are inclined to execute the intentions, provided the right amount of control over behavior is exercised.

Vamvaka et al. (2020) define intention as follows: an individual's readiness for performing an activity. According to Vamvaka et al. (2020), forming an entrepreneurial intention represents a process that happens over a period of time and is often referred to as the "entrepreneurial ladder." There were many scholars in the past that focused on studying the impact of gender on entrepreneurial intentions and attitudes of people. Nevertheless, the results of their research are contradictory in nature. The fact that gender was considered as a moderator variable in certain studies and as an independent variable in others, with the influence on intention being entirely regulated by other intervening variables, could be a reasonable explanation for these discrepancies.

Liñán et al. (2022) explain that culture plays a significant role in shaping the entrepreneurial intention as well as the entrepreneurial behavior of an individual. Similarly, one society can be supportive of entrepreneurship while the other one is not that much. This is due to the cultural differences that exist between different societies of the world. Moreover, it is also essential to highlight that people of the same society may be supportive of only a particular group within the society while ignoring the desires of other subgroups. This partial approach of people belonging to certain societies leads to cultural issues while embracing entrepreneurship. More precisely, decades of data support that fewer females come as entrepreneurs in comparison to males in almost every country. In the following section, we attempt to explain the reason behind this discrepancy and also

throw light on how entrepreneurial intention is influenced.

The existing literature (Liñán et al., 2022) on this subject points out that women often face obstacles when starting their own businesses. It is a common belief that gender stereotypes and biases are to be primarily held responsible for explaining this huge gender gap. Furthermore, cultural roots and religious beliefs are believed to shape the traditional mindsets that encourage women's involvement mostly in household chores. Therefore, it is also important to highlight that, more or less, the majority of religions worldwide ignore the importance of gender equality. In fact, they strongly emphasize females' roles as homemakers, and since many people within society follow religious teachings and lead their lives by religious beliefs and values, one may argue that religion can influence a female's entrepreneurial intentions by shaping society's mentality. Moreover, such beliefs can also impact one's approach to work-life balance, thereby influencing one's entrepreneurial decisions (Franzke et al., 2022).

As a result, several reports demonstrate that the level of entrepreneurial activity is lower among females in comparison to males. Regardless of all this evidence, there are some researchers (Liñán et al., 2022) who still believe that to draw such a comparison is not at all appropriate because of the inherent personality traits between the two genders and their roles in society. However, some scholars (Liñán et al., 2022) argue that gender stereotypes are one of the main causes of this huge difference.

According to a study (Vamvaka et al., 2020), gender also plays a major role in forming and shaping entrepreneurial intentions. The underlying reason for this is believed to be the general perception of society regarding entrepreneurship. They attribute it to being a profession that is more suited for men. Furthermore, men hold comparatively more positive opinions regarding entrepreneurship, and thereby, they are more willing to start their own company. According to Liñán et al. (2022), entrepreneurship is associated with masculine characteristics. Since an entrepreneur is commonly perceived by the society as someone who is aggressive and ambitious, these characteristics do not fit in females, who are usually perceived as emotional (Cardella et al., 2020). However, besides culture, there are also other factors that impact entrepreneurial intention (Liñán et al., 2022).

It is crucial to emphasize that gender bias is not only a result of society's traditional perception. Oftentimes, it is a by-product of self-perception that lets females think that they are not competent enough to be entrepreneurs. Competitiveness, self-confidence, and leadership skills are some classic examples of traits that are not valued in women but help in coping with a competitive business environment (Ughetto et al., 2020). Education is another factor that is commonly believed to influence entrepreneurial motivation. Previous research (Franzke et al., 2022) claims that in developing nations, more educated females tend to have greater levels of entrepreneurial motivation in comparison to the ones without any educational background.

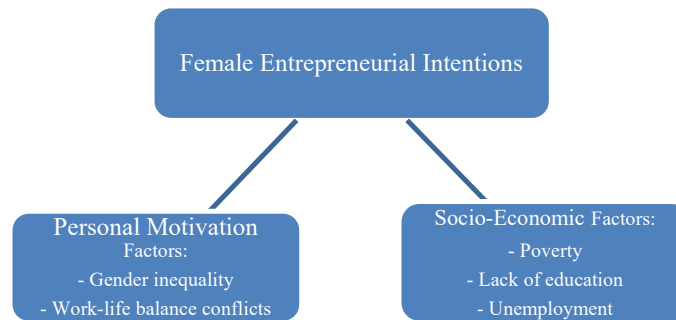
As discussed earlier, there are several factors that affect the entrepreneurial intentions of a female. According to Franzke et al. (2022), all these factors can be categorized into: Personal Motivation Factors and Socio-Economic Factors (figure no. 1).

As per the findings of Vamvaka et al. (2020), men are more likely to transform their entrepreneurial intentions into reality, which shows that the difference in the number of men and women starting up businesses comes into existence at the execution phase of the entrepreneurial process instead of the intention development phase.

Formation of entrepreneurial intention is described by Vamvaka et al. (2020) in three stages:

- **Latent entrepreneurship:** A latent entrepreneur is someone who has the desire to start up the business but doesn't engage in necessary actions to fulfill this desire.
- **Commitment to entrepreneurship:** This stage represents the strong intention of a person to remain committed to starting a new company.
- **Nascent entrepreneurship:** This final stage revolves around transforming entrepreneurial intentions to reality by carrying out relevant activities linked with entrepreneurship.

Figure no. 1 Female entrepreneurial intentions



Source: Franzke et al. (2022)

Figure no. 2 Entrepreneurial process



Source: Vamvaka et al. (2020)

It is crucial to highlight that while discussing the intention of female entrepreneurs, one must not forget that female entrepreneurship is a nuanced subject, as female entrepreneurs do not represent a homogenous group of a society. For instance, women entrepreneurs in Western countries have different behavior than the ones in Eastern countries (Cardella et al., 2020). An interesting insight is that the entrepreneurial behavior of females living in Western countries also differs from those living in Eastern parts of the world. More precisely, western females are less likely to start a company only due to necessity.

Franzke et al. (2022) mentioned that the Asian female entrepreneurs are usually less open to taking business-related risks, and their companies generate less revenue. Some researchers also claim that female entrepreneurs in Asian countries suffer more from low self-confidence because of the social norms. Moreover, in some cultures, family support is not provided to female members for starting the business. Even though urbanization has contributed to changing the traditional mindsets of society, gender stereotypes still bloom. This in turn leads to fewer females taking courage and initiatives to start their own company (Franzke et al., 2022). Regardless of all the cultural norms, some women still choose to decide their own career path, as Jafari-Sadeghi (2020) asserts that females are often seen starting up their own businesses because of self-development.

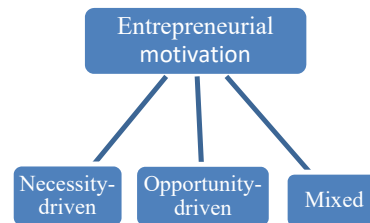
4.2. Entrepreneurial motivation

Both genders decide to start a new business because of distinct reasons. Hence, one may argue that a significant factor to start a new company is motivation. According to Jafari-Sadeghi (2020), motivation is the key element that stimulates or encourages a person to be engaged in entrepreneurial activities. Therefore, depending on the level of motivation, an individual decides whether to execute the business plan or not.

Entrepreneurial intentions of a female reflect entrepreneurial motivation. In other words, motivation is a way of expressing intention. Since engaging in entrepreneurial activities is an individual choice, it is strongly affected by entrepreneurial motivation. Higher entrepreneurial motivation of a person leads to an increased probability of an individual starting a business. Motivation represents internal or the external drive that encourages a person to move towards accomplishing an objective, and it can be of two types: intrinsic and extrinsic. Since extrinsic motivation is driven by external conditions, one may argue that to some extent, entrepreneurial motivation also depends on external environment of a female (Franzke et al., 2022).

Previous literature (Jafari-Sadeghi et al., 2020) highlights a clear distinction between necessity-driven, opportunity-driven, and mixed motivation.

Figure no. 3 Types of entrepreneurial motivations



Source: Jafari-Sadeghi et al. (2020)

Previous literature (Jafari-Sadeghi et al., 2020) highlights a clear distinction between necessity-driven, opportunity-driven, and mixed motivation. Opportunity-driven entrepreneurship is a category of entrepreneurship that requires the entrepreneur to start a company for pursuing an opportunity rather than feeling obligated to do so. In necessity-driven entrepreneurship, starting a business is a forced choice for the entrepreneur (potentially due to economic and financial conditions, unemployment, etc.). The third category of motivation, namely, mixed motivation, explains the theory that suggests that both the aforementioned kinds of motivation can lead to entrepreneurship. For instance, an individual faces a financial crisis and seeks a business opportunity that can help him to generate income. In this case, the person is driven by both the necessity as well as the opportunity. Based on the above arguments, one may conclude that both males and females start their own companies due to lack of income as well as for exploiting a new business opportunity.

An average of 350 out of 100,000 people, or 0.35% of the adults, started a new business every month in 2023 (Fairlie, 2024). It's critical to comprehend the percentage of female entrepreneurs in that number and to solve the obstacles they encounter. Women's greater participation could raise this number and promote inclusive economic growth and innovation.

The new opportunity-driven business owners offer a comprehensive understanding of how the state of the economy affects new business development in general. It makes a distinction between people who are "necessity entrepreneurs" because of unemployment and people who are "opportunity entrepreneurs," such as those who are leaving the workforce, educational institutions, or other labor market status. The percentage of new business owners who weren't jobless and looking for work when they launched their venture is known as the opportunity share of new business owners. Despite the fact that there are a variety of reasons people establish businesses (especially when considering the current state of the economy and the high unemployment rate), necessity businesses have the potential to achieve great success in the long run (Fairlie, 2024). However, females are often seen opening their company due to necessity rather than opportunity. This aforementioned statement might explain why females are less likely to be entrepreneurs in developing nations rather than in developed countries like the United States (Bento et al., 2024).

4.3 Gender gap and the importance of women entrepreneurship

According to a data report, the percentage of new female entrepreneurs in the United States is lower than that of male entrepreneurs for more than 15 years. It is interesting to highlight that although America is commonly known for its liberal mindset and positive entrepreneurial environment, women entrepreneurs are lagging even in such a developed nation. The table no.1 shows the trend in the percentage of new entrepreneurs in the US between 1996 and 2021 by gender. According to the study, in 2021, on average, around four in every ten new entrepreneurs were females.

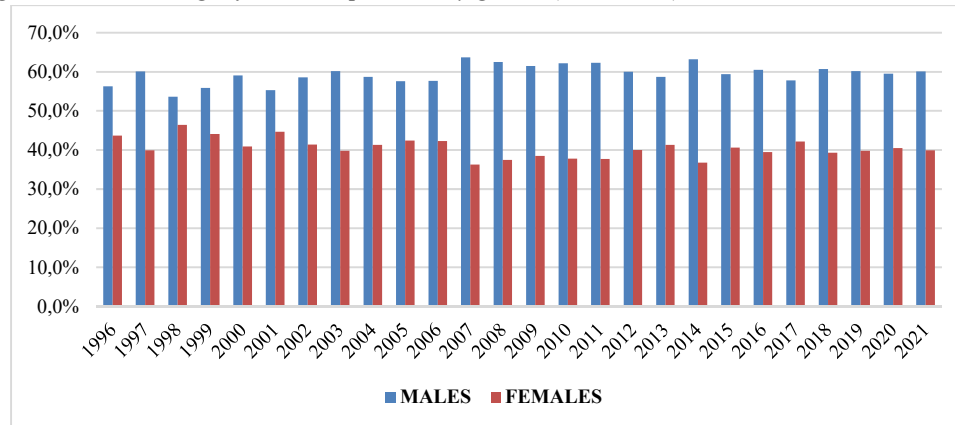
The figure no.4 is the graphical form of the data mentioned in the table no.1. As seen in figure no. 4, the percentage of new females engaging in entrepreneurship in the US is relatively consistent over a period of time (more precisely, between 1996-2021).

Table no. 1 Percentage of new entrepreneurs by gender

YEAR	MALES	FEMALES
1996	56.3%	43.7%
1997	60.1%	39.9%
1998	53.6%	46.4%
1999	55.9%	44.1%
2000	59.1%	40.9%
2001	55.3%	44.7%
2002	58.6%	41.4%
2003	60.2%	39.8%
2004	58.7%	41.3%
2005	57.6%	42.4%
2006	57.7%	42.3%
2007	63.7%	36.3%
2008	62.5%	37.5%
2009	61.5%	38.5%
2010	62.2%	37.8%
2011	62.3%	37.7%
2012	60.0%	40.0%
2013	58.7%	41.3%
2014	63.2%	36.8%
2015	59.4%	40.6%
2016	60.5%	39.5%
2017	57.8%	42.2%
2018	60.7%	39.3%
2019	60.2%	39.8%
2020	59.5%	40.5%
2021	60.1%	39.9%

Source: Ewing Marion Kauffman Foundation (2022)

Figure no. 4 Percentage of new entrepreneurs by gender (1996–2021)



Source: Ewing Marion Kauffman Foundation (2022)

Fairlie (2024) claims that it is imperative to measure such trends in entrepreneurship to better understand the state of an economy. Nevertheless, there is not sufficient high-quality data available from credible sources.

All the gender biases, stereotypes, social norms, cultural mindsets, and beliefs demotivate females to start up their own companies. Furthermore, these stereotypes don't just impact individual choice and entrepreneurial intentions; they also marginalize women. For instance, according to a study, women in general have 63% less chance of obtaining external financing and raising capital in comparison to men. Hebert (2023) also agrees with the aforementioned statement and supports it by stating that a gender gap clearly exists in entrepreneurial financing as well. For instance, statistics show around 30% of the start-up founders are females. However, only 10 to 15% of these women succeed in raising venture capital or another form of external financing.

In the past, several researchers (Ughetto et al., 2020) suggested that fewer females opt for debt capital and obtain external financing less frequently in comparison to males. Ughetto et al. (2020) claim that this gender gap eventually results in underperformance due to insufficient funds for the business to grow in the early phase. More precisely, gender bias is not seen at the approval/rejection phase; rather, females are demanded to pay comparatively greater interest rates. Hebert (2023) concludes that investors usually miss incredibly amazing investing opportunities because of either overlooking women start-up founders or sometimes due to not searching for them actively.

Some researchers (Hebert, 2023) also attempted to explain this gap by differences in risk-taking approach, behavior, and overall attitudes in both genders. They claim that females tend to take fewer risks in any given situation in comparison to men, which allows them access to fewer opportunities. Nevertheless, some hold the following opinion: "Discrimination might be a significant factor contributing to this gender gap". Moreover, there is a possibility that the gender gap exists due to both the reasons mentioned above, that is, risk-taking behavioral differences as well as gender discrimination.

Morazzoni and Sy (2022) explain that female businesses are penalized comparatively more by credit limits. Moreover, women entrepreneurs not only report lower business debt levels, but they also have a 10% greater likelihood of being denied a loan.

Hebert (2023) mentions in his study that women entrepreneurs are usually less prone to raise money for starting a business through venture capital. Moreover, the paper reveals that start-ups founded by women are more likely to perform better when venture capital is being provided. To be precise, according to a study conducted among French start-ups founded between the interval 2002-2018, women entrepreneurs are apparently 22% less likely to accumulate external financing for starting their own firm in comparison to businessmen. Another interesting aspect that this study covered was that this gap widened in highly male-dominating sectors, where men had 4 times more chances to raise external funding. However, in female-dominating sectors, women do not have less chances to obtain external financing.

In the United States, only 35% of the entrepreneurs are women, which clearly suggests that there exists a prominent gender gap, which marginalizes females. In the year 2018, female entrepreneurs secured only 2.2% of the total startup funding. Although the proportion of female entrepreneurs in the US has increased in recent years, there are still noticeable gender differences in a number of entrepreneurial aspects (Morazzoni and Sy, 2022).

Another interesting aspect is that the behavior of women who prioritize family is believed to negatively impact workplace productivity, thus making it an obstacle for them to grow in their careers. In fact, previous literature suggests that work-family conflict is one of the major reasons why women choose to be entrepreneurs in the first place (Zandberg, 2021). As per the common belief, entrepreneurship permits women the much-required flexibility that cannot be replaced in a usual job. This helps them to better improve work-life balance (Cardella et al., 2020). Work-life balance is defined by Kaur and Trifan (2022) as the ability of an employee or worker to maintain a healthy balance between work-related responsibilities as well as individual aspirations.

According to traditional beliefs, women are primarily held responsible for managing the household chores. Therefore, it is natural for the females to feel societal pressure and prioritize family life more than career. This attitude often discourages women from fulfilling their dreams.

Due to growing participation of women in entrepreneurial activities, scholars have started to concentrate on the scope of gender and how both men and women add unique value to their startups. It is believed that usually female startups provide a lot of attention to the diversity of business operations, which contributes to better entrepreneurial quality. Nevertheless, females are seen as somewhat less ambitious and less value-adding entrepreneurs in comparison to their male peers (Jafari-Sadeghi, 2020).

The existing literature indicates that the average revenue product of capital for women-led businesses is 12% greater than that of male-led businesses with comparable attributes (Morazzoni and Sy, 2022). Due to their creative approach and cooperative nature, women are more likely to take informed decisions (Ughetto et al., 2020). The positive influence of women in leadership on financial performance is still a debated subject. While some scholars claim that there is no direct correlation or link between the leader's gender and firm performance, other researchers argue that female entrepreneurship indeed enhances the overall firm performance. Hence, one may conclude that there is no consensus on this subject (Ughetto et al., 2020). Nevertheless, as Cardella et al. (2020) suggest, it is imperative to be inclusive of women in entrepreneurship culture, as they have the ability to bring new ideas and shape a safe business environment.

Lastly, the entrepreneurial environment is going under a transformation phase due to globalization and digitalization. This change has led to increasing market opportunities for females. In this context, Ughetto (2020) encourages the concerned authorities to embrace innovative methods for stimulating women's entrepreneurship that also affirm consideration of digital aspects.

5. Conclusions

To conclude, this study discussed the key elements influencing the gender gap in entrepreneurship, paying particular attention to the ways in which cultural, institutional, and financial barriers affect women's entrepreneurial aspirations and actions. The analysis of current research demonstrates that women entrepreneurs encounter numerous obstacles, ranging from ingrained cultural prejudices and gendered expectations on work-life balance to restricted access to outside capital. In addition to lowering the proportion of women engaged in entrepreneurship, these obstacles also make it more difficult for them to grow their businesses and achieve success on par with males. In order to promote a more equitable and open entrepreneurial environment, it is imperative that these structural inequities are addressed regularly (Ilie et al., 2021).

The study also shows that women's motivations for starting their own businesses are quite different than men's. Women often place a higher value on social impact, work-life balance, and autonomy than just financial gain. Despite these admirable goals, gendered stereotypes—such as the idea that women put their families before their careers—continue to damage women's reputations as business owners.

The idea that women are less suitable for entrepreneurship is further supported by the fact that cultural expectations that entrepreneurs should be self-centered and ambitious frequently clash with the traits associated with women, such as emotional sensitivity and kindness. The key to enabling more women to participate confidently in entrepreneurial endeavors is overcoming these gender biases and stereotypes.

It is evident from addressing the research question that women's entrepreneurial experiences and prospects are significantly shaped by societal barriers and gender-specific motives. According to the findings, despite the fact that more women are assuming leadership positions and launching their own companies, systemic injustices and long-standing preconceptions continue to fuel the gender gap.

Targeted initiatives are required to close this gap, including expanding access to financial resources, advocating for legislation that support them, and eliminating gender stereotypes. Addressing gender biases requires changing society's perception, which is complex process and requires educating younger generations. Raising awareness among people regarding the gender gap that prevails due to gender biases may help them in making more conscious, well-informed decisions.

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Applicability of IT Systems in Business in the Context of the Digitalization of Economic Processes

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Abstract

In a dynamic economic environment characterized by intense competition and the demand for real-time information, information systems—particularly cloud-based solutions—play a critical role in ensuring competitiveness. Knowledge-based organizations leverage these systems to collect, extract, label, organize, process, and disseminate knowledge, thereby enabling more effective business solutions and informed decision-making. These systems also enhance collaboration and improve access to relevant information.

The responsiveness of Information Systems (IS) is crucial for adapting to rapid economic changes. This study focuses on cloud-based Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM) systems, highlighting their contributions to efficient resource management and improved decision-making processes. The methodology involves a comparative analysis of companies that have implemented ERP/CRM solutions versus those that have not, using data derived from case studies and financial analyses. Adapting the decision-making process represents a significant factor in distinguishing a successful organization from one operating at a deficit or an efficient public service or administration from a bureaucratic one.

Key words: digitalization, cloud computing, ERP, data security, competitiveness

J.E.L. classification: C81, M10, O32

1. Introduction

In the era of accelerated digitalization, enterprises worldwide are under constant pressure to optimize their processes and remain competitive in a globalized economic environment. The digitalization of economic processes involves integrating information technologies (IT) into all aspects of an organization's activities, facilitating real-time access to information, reducing operational costs, and improving decision-making efficiency. Among these technologies, ERP (Enterprise Resource Planning) and CRM (Customer Relationship Management) systems play a central role in managing organizational resources and customer relationships.

According to authors Jacobs, F.R., and Bendoly, E. (2003), ERP represents an information system that integrates and manages all aspects of business knowledge, including production planning, sales, procurement, distribution, services, accounting, and customer relationship management. In 2011, Parker, B. analyzed Business Intelligence tools and found that they could be interfaced with ERP systems to improve managerial decision-making and provide useful insights on organizational positioning, market trends, and competitor information. An ERP system must deliver structured information, covering the entire organizational activity down to departmental performance, with detailed data on specific activities. While a standard ERP package may be a solution for small and medium-sized enterprises, larger companies require customized systems tailored to their specific

needs. Likewise, CRM systems play a crucial role in managing customer interactions, enhancing satisfaction and loyalty. The integration of CRM with ERP systems provides companies with a holistic approach, not only to internal operations but also to market engagement and customer relationships.

As digitalization progresses, an increasing number of companies are choosing to adopt cloud-based ERP and CRM solutions. Cloud computing offers enhanced flexibility, scalability, and accessibility, eliminating the need for costly hardware infrastructure and reducing maintenance costs. In this new business model, companies can leverage external IT resources, paying only for what they consume, which allows them to adapt quickly to economic changes and focus on innovation and growth. The adoption of cloud-based ERP and CRM systems has thus become a vital strategy for companies seeking to remain competitive, streamline their processes, and improve their customer relationships. This study examines how these systems can transform companies, presenting real-world cases and economic analyses that demonstrate the positive impact of these solutions on organizational performance.

2. Literature review

In recent years, research on business digitalization and the integration of information systems, such as ERP and CRM, has intensified, reflecting the need for companies to adapt rapidly to the dynamic economic environment. Cloud technologies, especially Software as a Service (SaaS) solutions, have become a popular choice due to their reduced costs and increased scalability. A review of recent literature demonstrates the importance of these technologies in enhancing operational efficiency and supporting market competitiveness.

Several recent studies have examined the impact of digitalization on companies, emphasizing that adopting digital technologies is essential for maintaining market competitiveness. Kauffman and Ma (2021) highlighted that with the increase in data volume and the complexity of economic processes, companies adopting digital solutions gain greater adaptability to market changes. Moreover, the McKinsey Global Institute (2020) showed that digitalization could increase a company's productivity by up to 25% by optimizing processes and improving managerial decisions. ERP and CRM systems have been recognized as crucial for the efficient management of resources and customer relationships.

According to Thomas and Rowe (2022), the implementation of these systems, particularly when cloud-based, provides companies with a competitive advantage by reducing operational costs and improving transparency within the supply chain. Additionally, research by Cheng and Liu (2021) demonstrated that adopting modern ERP systems can reduce implementation time by 30%, while also enhancing resource management and operational efficiency. The adoption of cloud technologies and SaaS solutions has significantly accelerated in recent years. Kapoor and Murthy (2020) emphasized that migrating to cloud solutions offers substantial benefits, such as reduced IT infrastructure costs and increased scalability. Furthermore, a study by Gartner (2021) found that 70% of companies that adopted SaaS solutions experienced a significant increase in productivity and a reduction in downtime. Another important aspect discussed in the literature is data security in the cloud. Researchers Smith and Johnson (2023) highlighted that as cloud adoption grows, protecting against cyberattacks becomes a major concern. Their study shows that advanced security measures, such as encryption and multi-factor authentication, have significantly reduced the risks of cyberattacks for companies that adopted cloud solutions.

Zhou and Tang (2022) explore the integration of artificial intelligence (AI) and Business Intelligence (BI) solutions within ERP and CRM systems. These advanced technologies enable companies to analyze large volumes of data and make informed decisions, boosting operational efficiency and providing valuable insights into market trends and consumer behavior.

3. Findings

3.1. Cloud computing - a new business model

Given the rapid growth in the volume of information within companies and the increasing variety of data types that need storage, businesses require a modern approach to unify the management of their applications and data files, enabling them to adapt more flexibly to market dynamics. To remain competitive and effectively manage the large quantities of information, many companies are turning to IT infrastructure outsourcing services.

Outsourcing IT infrastructure to "data centers" enhances employee productivity, mitigates or eliminates substantial costs associated with major disruptions, safeguards data against accidental or intentional loss or damage, and facilitates the swift resumption of critical operations after interruptions. The adoption of cloud computing is also expanding in developing countries. Globally, cloud-based software applications accessible via the Internet represent a multi-billion euro industry. In Romania, the market is still emerging, with only a limited number of companies currently leveraging such solutions. Significant effort is required to educate businesses about the potential benefits of cloud computing. Providers of cloud hosting services offer an array of options, including hosting, installation, and cloud computing services, as well as crucial complementary services like business continuity, data backup, and disaster recovery.

Cloud computing enables the use of external IT resources configured to specific needs, with costs determined based on actual consumption. For instance, a business can access a tailored suite of applications in the cloud for a limited number of employees, optimizing IT expenditures. This approach introduces a new business model where technology is delivered as an online service. Users access software applications via the Internet without purchasing licenses, instead paying a monthly fee. For businesses, cloud computing offers two major advantages: reduced expenses and the efficient allocation of resources, adjusted precisely to the current workforce size. To illustrate, traditional IT solutions can be likened to owning and maintaining a personal vehicle, whereas cloud computing resembles a car-sharing service, offering flexibility and cost savings. Enterprise Resource Planning [ERP Software Gets a Second Life in the Cloud by Cindy Waxer, July 14, 2011 Technology Review, published by MIT] promised to automate and integrate everything from order tracking to product distribution and production scheduling. Now, however, innovations are making the technology more useful and cost-effective. The software can be hosted remotely ("in the cloud") and used on mobile phones. It can help manufacturers reduce costs and streamline their operations for much less than the costs of traditional ERP systems. [Waxer,C., 2011 Review Technology]

SaaS stands for "Software as a Service" and is essentially the "rental" of software. SaaS applications are generally web-based, accessible from anywhere, requiring only a browser and an Internet connection. "While some customers are reluctant to move business-critical applications to the cloud, others see clear cost benefits." [Ramdas S., Sonal Desai, CRN. - Computer Reseller News, The Cloud Landscape by Ramdas S and Sonal Desai].

3.2. The Benefits and Trends of Adopting ERP and CRM in the Modern Business Environment

It provides flexibility in activity management and scalability, along with opportunities to develop new functionalities. Experience gained from implementing CRM and ERP systems highlights the importance of thoroughly analyzing both internal and external factors that influence a company's growth. This analysis is critical for transforming such systems into effective tools for management decision-making. Introducing an Integrated Information System within a company can be a lengthy and costly process. The drive to minimize these costs has spurred the evolution of these solutions and the advancement of new technologies.

The Cloud-based ERP system represents a modern alternative, offering a flexible, adaptable, scalable, efficient, and cost-effective approach. Unlike traditional ERP systems, the Cloud solution is designed to streamline deployment, facilitate faster upgrades, and provide extensive customization options. With features such as accessibility "anytime and anywhere," quick implementation, and online technical support, businesses can significantly enhance their operations.

As with any implementation model, both benefits and challenges must be considered. However, the Cloud ERP solution delivers enhanced business value by meeting organizational requirements more effectively, ultimately boosting both individual and organizational productivity. "But, it is important to remember that the ERP solution in the Cloud (ERP – New Dog, Same Fleas, May 22, 2011 by Brett Beaubouef) is not a shortcut to success" [Beaubouef B., 2011].

Figure no. 1 Advantages of migrating to Online

Advantages of migrating to Online	Increasing the productivity of mobile users or those who do not have a dedicated computer (Deskless Workers)
	Realizes Cost Savings
	Quickly implement and expand role-based functionalities according to needs
	Benefit from the already tested infrastructure of data centers dedicated to online services

Source: Created by the author, <https://www.bitdefender.ro/business>

The advantages embedded in technology include flexibility, which allows for adaptations and updates to meet evolving needs.

1. Flexibility is a fundamental principle in technology design, driven by market evolution and the dynamic nature of demand, both in quantity and quality, requiring a rapid response to changes. This flexibility introduces new challenges from the design phase, demanding adaptability, integrability, and dynamic design to manage complexity and support system optimization.
2. Scalability offers the possibility of expanding licenses as activities grow.
3. Reliability is assured throughout the system's life cycle—defined during design, established in implementation, and maintained through consistent control.
4. Security design considers reliability, maintainability, and protection against predictable and unforeseen failures.
5. Maintenance also gains importance as systems grow more complex, ensuring that issues are resolved quickly.
6. Ergonomics focuses on user-friendly interfaces that facilitate routine tasks, anticipate errors, validate intermediate steps, and allow corrections.
7. Integration between workflows. A particularly important aspect in choosing a solution is data security, operation without interruptions and without data loss.

Cloud technology emphasizes safeguarding data, ensuring both its integrity and security. Hardware and operating systems, whether proprietary or open source, must be developed with robust measures to prevent and counter cyber-attacks. The Cloud model must incorporate a structured approach that restricts access to cloud data through multiple layers of security.

Managing security remains a complex challenge, as protection systems must be continuously enhanced. Despite advanced technologies, vulnerabilities can still emerge and may be exploited. The primary risks faced by end users and IT security professionals involve preventing cyber-attacks and minimizing losses. The increasing threat of cyber-attacks has made customers more cautious about online payment systems and virtual business platforms. Governments must recognize these risks, enact appropriate policies, and adapt legislation to mitigate the impact of cyber-attacks. As a member of the European Union, Romania has aligned its data protection regulations with the EU Data Protection Directive, strengthening its legal framework. Romania has also established itself as a strong player in the competitive global cybersecurity market. A noteworthy example is the Romanian company Bitdefender, a leader in internet security solutions and antivirus software.

The critical focus for users and IT security specialists remains on minimizing risks, enhancing preventive measures, and reducing the impact of potential cyber threats.

Table no. 1. Recommendations that can reduce the risks of cyber-terrorist attacks.

Risks	Recommendation
The Operating System is not updated	Up-date must be installed regularly
The system is not secured with a strong password	Passwords must be changed regularly
Unprotected system	The system must be protected with a firewall and applications updated antivirus software
Unsolicited or suspicious emails	Should be avoided or opened with caution
Email, file and application servers are not secure	Servers must be protected with a strong security solution
Devices connected to the Internet are not secured	All devices connected to the Internet must be secured to prevent unauthorized access

Source: processing after the site <https://www.bitdefender.ro/business>

In recent years, the adoption of digital technologies has become essential for companies seeking to remain competitive in a dynamic economic environment. Cloud-based ERP and CRM solutions, recognized for their flexibility and scalability, play a central role in process optimization and efficient resource management. The data presented in the tables below highlight current trends and the economic impact of these technologies on organizations of all sizes. The study includes comparative analyses between companies that have adopted cloud solutions and those that have not yet implemented such technologies, emphasizing differences in operational efficiency and competitiveness.

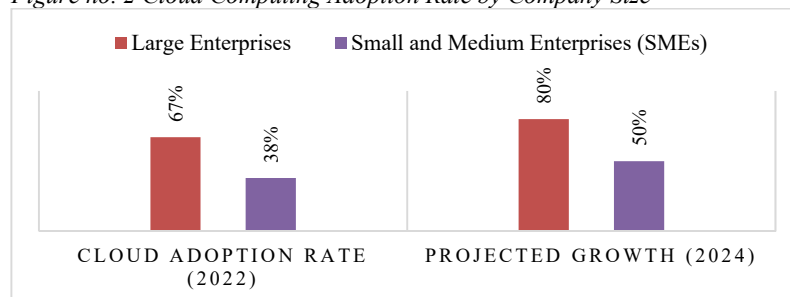
Table no. 2. Global Cloud Computing Market Growth (2020-2024)

Year	Global Cloud Computing Market Value (billion USD)
2020	371,1
2021	421,0
2022	545,8
2023	597,3
2024	675,0 (projected)

Source: Created by the author based on data sourced from Statista,
<https://www.statista.com/statistics/273818/global-revenue-generated-with-cloud-computing-since-2009/>

Table no.2 highlights the steady growth of the global cloud computing market from 2020 to a projected 675 billion USD in 2024. This increase reflects the widespread adoption of cloud solutions driven by the need for digital transformation, especially due to the rise of remote work, increased automation, and the pursuit of cost efficiency. The data demonstrate a compound annual growth rate (CAGR) of approximately 17.9%, showing cloud computing's strong appeal across industries as a cost-effective and flexible IT solution.

Figure no. 2 Cloud Computing Adoption Rate by Company Size

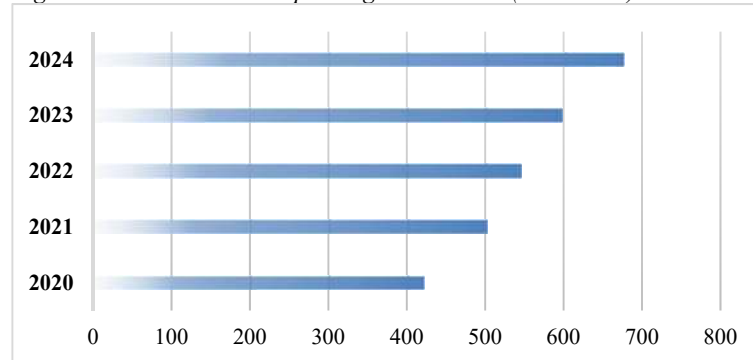


Source: Created by the author based on data sourced from McKinsey Global Institute,
<https://www.mckinsey.com>

The adoption of cloud technologies differs significantly by company size. Large enterprises lead with a 67% adoption rate, projected to reach 80% by 2024, largely due to their ability to allocate substantial resources to digital transformation initiatives. For SMEs, adoption is projected to grow from 38% to 50% by 2024, driven by increasing accessibility to scalable, cloud-based solutions. This trend illustrates that cloud solutions are becoming essential tools for companies of all sizes, providing them with a competitive edge through enhanced flexibility and cost savings.

The data show a significant increase in public cloud spending from 421 billion USD in 2020 to a projected 675 billion USD by 2024. Public cloud services, such as SaaS (Software as a Service) and IaaS (Infrastructure as a Service), are increasingly preferred due to their ability to lower infrastructure costs, offer scalable resources, and facilitate rapid implementation.

Figure no. 3 Public Cloud Spending Distribution (2020-2024)



Source: Created by the author based on data sourced from Flexera's State of the Cloud Report 2023

This shift towards public cloud solutions underscores their vital role in supporting business agility and cost efficiency in a dynamic economic landscape.

Table no. 3 Benefits of Cloud Computing for Companies

Benefit	Description
Cost Reduction	Reduces Total Cost of Ownership (TCO) by 30-40% and eliminates maintenance costs
Business Resilience	Disaster recovery times are reduced to as little as 2.1 hours
Environmental Impact	Carbon emissions reduced by 84% for companies switching from on-premise to cloud solutions
Flexibility and Scalability	Allows rapid adjustment of resources according to demand

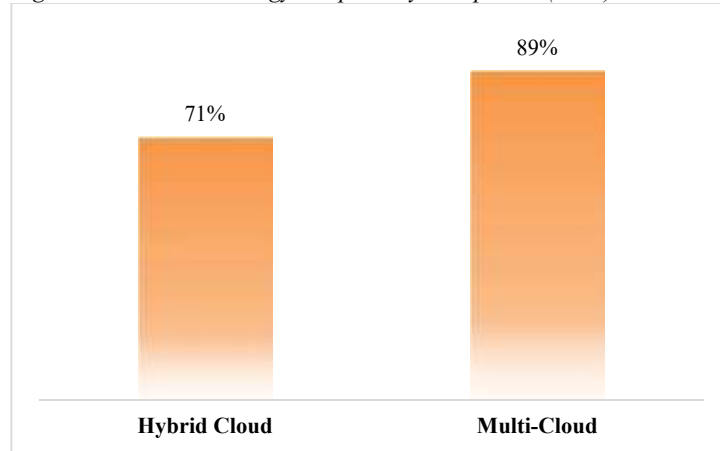
Source: Created by the author based on information from the Accenture report "Environmental Benefits of Cloud Computing"

This table outlines the major benefits of adopting cloud computing, with cost reduction and enhanced business resilience at the forefront. Reduced TCO and eliminated maintenance costs make cloud solutions highly attractive. Additionally, cloud infrastructure supports rapid disaster recovery, significantly reducing downtime. Companies can also achieve substantial reductions in carbon emissions, making cloud solutions not only economically viable but also environmentally responsible. The flexibility and scalability offered by cloud computing allow companies to efficiently respond to fluctuating market demands.

The widespread adoption of hybrid and multi-cloud strategies reflects companies' pursuit of balance between security, cost, and performance. In 2022, 71% of companies used a hybrid cloud approach, integrating public and private cloud environments to maintain data security while

leveraging public cloud cost advantages. Furthermore, 89% of organizations employed a multi-cloud strategy, indicating a preference for flexibility and avoiding vendor lock-in.

Figure no. 4 Cloud Strategy Adoption by Companies (2022)



Source: Created by the author based on data sourced from Thales Data Threat Report <https://cpl.thalesgroup.com/2022/data-threat-report>

This trend illustrates a strategic approach to cloud adoption, allowing companies to select the best services from multiple providers while minimizing risk.

4. Case study: expanding the service offering – SaaS and WizPro ERP

In recent years, ERP providers have focused on small and medium-sized companies. The acquisition, configuration and administration of servers require time and capital, resources to which small and medium-sized businesses are very sensitive. In addition, small and medium-sized enterprises do not have the IT infrastructure or the budget necessary to implement, maintain, update, secure and manage their own servers to ensure continuity and are, as a rule, stuck, using rudimentary systems and less performing applications that reduce productivity.

Wizrom Software is a provider of business management software solutions on the Romanian market since 1992. The situation it faced was to analyze and decide what the strategy would be to support the increase in the number of clients and projects every year, in the conditions in which it was more and more difficult for companies to invest, purchase and pay the full price of the solution, whether it was the software part or the infrastructure. At the same time, many client companies have reorganized their businesses, and efficiency has become the watchword in any business. To face a market in which client companies no longer had the same budgets as in the past, solutions were sought and examined both for keeping current clients and for attracting new clients.

The company analyzed the IT requirements vs those from the Business perspective for the implementation of an ERP-type SII.

The objectives pursued from an IT point of view:

- Management, preservation and easy access to the knowledge and information base
- Maintaining compliance and preventing information loss
- Access for as many users as possible, with various requirements
- Expansion of existing investments

Pursued business objectives:

- Simplification and reduction of implementation costs
- Management of communications and collaboration
- Interoperating with clients and partners on a global level
- Maximizing productivity and innovation
- Attracting and keeping talents

These common objectives were found in the case of clients of all sizes and vertical industries, becoming challenges for finding alternative solutions for our case study company.

Figure no. 5 The existing IT&C technologies and the need for services at high quality standards

The existing IT&C technologies and the need for services at high quality standards facilitated the search for new solutions:	Renting software solutions through a system like operational leasing.
	Provision of integrated database hosting solutions and application rental.

Source: Created by the author, <https://www.bitdefender.ro/business>

Wizrom Software identified a growing demand in the business sector for comprehensive solutions, prompting increased investment in Software as a Service (SaaS) and cloud computing technologies. The company developed cloud-ready solutions and introduced alternative products to the market, creating innovative options tailored to the evolving needs of clients. The initial step in this transformation involved adapting their products to meet new market demands, enabling them to deliver specialized services to customers seeking to expand their operations and transition to online platforms.

Recognizing the advantages of an all-inclusive integrated solution, the software provider featured in this case study decided to incorporate this approach into their portfolio. The solution addresses genuine business needs, enhancing business value while driving both individual and organizational productivity. One significant advantage of choosing a hosting service provider is the optimized allocation of financial resources, coupled with access to high-quality infrastructure features such as redundancy, advanced cooling systems, and scalability for critical applications. Moreover, by offering cloud-based ERP solutions, even mid-sized IT companies can effectively compete with larger industry players, leveling the competitive landscape and broadening their market reach.

WizPro ERP is addressed to large companies in Romania that need to keep under control financial-accounting activities, management, logistics, sales, production, as well as the management of fixed assets. This ERP system provides integration and automation for all these core elements of any company's business, and additionally adds CRM functions for customer relationship management, project management, streamlining of maintenance and service activities, and production planning. The software suite proposed by Wizrom is an ERP solution that allows working from many devices: computer, laptop, mobile phone and tablet with Android and iOS operating systems. Accessible also in the form of a program that is installed on the computer (On Premise) and as SaaS (software as a service) in the cloud, WizPro ERP Romania is a modern ERP system that can be used from any device connected to the Internet.

The latest Gartner report includes WizPro ERP among the most relevant and performing ERP solutions with more than 7,000 customers worldwide. Wizrom has over 300 clients with approximately 10,000 users who use professional application hosting services in a Data Center.

Benefits of the Software as a Service (SaaS) solution:

- hardware equipment (database server, application server, back-up server);
- licenses (Windows Server, Terminal Services, Antivirus);
- firewall to secure data access; broadband Internet access in the Data Center;
- equipment maintenance services; electric current supply, redundant sources;
- daily back-up services for applications and databases; recovery in case of necessity.

The main objective is to expand the product offering, creating service options for each of the business software products.

In perspective, the company is counting on an increase in the demand for solutions that generate benefits as quickly as possible for its customers, considering that the efficiency of operating costs remains the basic challenge for all companies, in addition to attracting new customers. At the same time, at another level, the loyalty of existing customers is pursued by expanding the ERP system with new modules and integrating it with Intelligent Business solutions.

Currently, the new enterprise model version 2.0 is taking shape, oriented to the use of collaborative work platforms and tools that are based on emerging web 2.0 social technologies, within companies, or between companies and their partners or customers, which determines a changed attitude towards knowledge as well as towards power.

The Leaders 2020 global study, launched by SAP together with Oxford Economics, shows that only 16% of the participating companies have implemented leadership strategies adapted to the digital economy, strategies through which they managed to lead the digital transformation at the level of the entire company, to improve their performance and having more engaged employees. The study also showed that these companies managed to understand the importance of implementing such a strategy and to surpass their competition in a series of performance indicators. Thus, companies that benefit from the opportunities offered by the digital economy are 38% more likely to record increases in profit and revenue (76% versus 55%), have more satisfied employees (87% versus 63%), and enjoy of a higher degree of employee loyalty (75% versus 54%).

In the analysis, four directions were identified through which managers lead the digital transformation:

- the vision of the management regarding the integration of digital technologies in all activities and at all levels of the company.
- acceleration of the decision-making process – competitive organizations emphasize decision-making based on data analyzed in real time.
- simplification - reduction of complexity and bureaucracy, by making the latest technologies available to all employees; building a digital workforce – improving digital skills not only at the executive level, but at all levels, which allows a strategic use of these technologies.

5. Conclusions

The rapid increase in data volumes and the swift development of IT equipment are driving companies to adapt their strategies. The diversification of data types requiring management demands modern solutions for handling applications, files, and documents, enabling businesses to better align with market dynamics. In today's economic context, it is crucial for companies to cut costs and enhance their financial and economic performance. Cost reduction relies heavily on leveraging the potential of new technologies and IT&C services, such as Cloud Computing and Software as a Service.

New ERP SaaS or Cloud solutions are more cost-effective than traditional systems, especially for companies without the necessary infrastructure, as they reduce both implementation time and initial expenses. IT resources have become a key driver of success, acting not only as an operational backbone but also as tools for marketing and strategic initiatives. Organizations need to reassess the role of knowledge management in supporting decision-making processes. Strengthening digital and technological skills remains essential, even in times of crisis or financial constraints. Modern software applications speed up decision-making in the era of large-scale databases. Leading IT companies are introducing solutions designed to simplify data processing, decrease workloads, and accelerate processes while providing real-time access to information. Companies that have adopted data visualization tools have uncovered additional benefits. Combining advanced analytics with visualization technologies not only improves decision-making but also fosters cross-departmental collaboration to address complex business challenges.

In a competitive and rapidly changing economic environment, optimizing decision-making depends on the adaptability of IT systems to keep pace with evolving demands. These systems must provide real-time information to enable timely and informed decisions. IT companies prioritize offering competitive, innovative services that match the speed of technological advancements. At the same time, development strategies and decision-making processes remain essential pillars for the growth and sustainability of organizations.

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The Role of Education and Training in Preparing Sustainable Business Models for Small and Medium Enterprises: Current Experiences and Empirical Research

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Abstract

This study examines the critical role of education and training in developing sustainable business models for small and medium enterprises (SMEs). Using Moldova as a case study, the research highlights the importance of structured educational programs and training practices in addressing strategic and operational challenges faced by SMEs in their transition to sustainability. Key findings reveal that targeted educational initiatives not only enhance SMEs' ability to implement sustainable practices but also strengthen their resilience in competitive markets. The paper underscores the integration of theoretical frameworks with practical training methodologies, emphasizing their contribution to achieving long-term environmental, social, and economic goals. By analyzing empirical data and current experiences, the study provides actionable recommendations for policymakers, educators, and entrepreneurs aimed at fostering sustainability in the SME sector.

Key words: sustainability, SMEs, Training, Education, Business models

J.E.L. Classification: Q01, L26, I25

1. Introduction

The fundamental role of sustainable development for small and medium-sized enterprises (SMEs) is primarily associated with solving strategic socio-economic and environmental challenges, which cannot be achieved in many countries without the contribution of SMEs. In the context of the Republic of Moldova, it is important to emphasize that SMEs account for 98.6% of the country's total economy (Point.md, 2024), and their sustainable development would effectively represent a transition to a sustainable economy. However, our previous research has shown that the transition to sustainable business models by SMEs faces challenges due to the lack of advanced training practices for management and staff, limited awareness, and the need for support in undertaking sustainable transformations (Lîsii and Volosiuc, 2024, p. 157-161). Given the crucial role of education and training in preparing sustainable business models for SMEs, it is necessary to postulate the fundamental elements of supporting sustainable SME development both theoretically and practically through training and support for transformations.

2. Theoretical background

The initiation of sustainable business model development requires comprehensive methodologies for training and preparing SMEs, which involve identifying relevant issues, synthesizing existing practices, and addressing gaps in sustainable development education. Prior research highlights key barriers SMEs face, including financial constraints and limited knowledge. Literature emphasizes the

importance of integrating theoretical frameworks with practical applications, such as the development of educational programs tailored to sustainability. Studies by Pramudyastuti O.L (2023) and Jong F.D (2023) demonstrate the significance of financial advisory services and leadership in embedding sustainable practices within SMEs. Additionally, international initiatives, such as UNEP's (United Nations Environment Programme) eco-innovation programs and the Cambridge Institute's SME Climate Hub, provide valuable insights into training approaches and best practices for sustainable development.

3. Research methodology

Our study consists of two parts. The first part examines experiences, relevant case studies, and specific challenges faced by SMEs in education and training when preparing sustainable business models. Special attention is paid to the European Union's programs for supporting sustainable SME transformations, as well as private experiences of in-house training for SMEs in sustainable development. In the second part, an online survey of 34 SME employees and business owners was conducted to substantiate the findings from the literature review regarding the role of training and the current prevalence of sustainable development training among SMEs. This survey enabled us to update and postulate the current state and role of education in preparing sustainable business models for SMEs in the Republic of Moldova.

The research employs both general scientific methods and a survey method, which allowed us to link theory, practice, and the results of empirical research, leading to key conclusions regarding the state of training practices in preparing sustainable business models for SMEs.

4. Findings

4.1. Current State of Education and Training for Sustainable Development

In this study, education and training for preparing sustainable business models for SMEs are understood as a set of processes involving formal, non-formal, and informal education. The objective is to increase the awareness of SME managers and employees about sustainable development, followed by the gradual integration of sustainable development processes and the logical transformation of business models towards sustainability (implementing social, environmental, and corporate governance principles—ESG principles in business). This training is initiated both internally by the SME (through management efforts to train employees, create a relevant culture, increase responsibility, etc.) and externally through training of managers and their alignment with sustainable development values.

Given the global popularization of sustainable development as a fundamental concept for businesses, education in the context of sustainable development is becoming increasingly crucial. As noted by O.L. Pramudyastuti and colleagues, based on their research, SME commitment to sustainable development remains relatively low in some regions, necessitating assistance with socialization and special training to accompany the implementation and gradual transition to sustainable business models for SMEs (Pramudyastuti et al., 2023, p.213).

Since our previous research has already addressed the theoretical foundations of education and training in preparing sustainable business models for SMEs, this study focuses specifically on current case studies and the practice of implementing socialization principles for entrepreneurs and in-house training for SME employees. Although such cases are few, they provide valuable insights into the importance of specific training factors for SME sustainable development.

For example, the work by F. Jong and K. Wagenveld illustrates that achieving sustainable development goals (UN SDGs) is impossible without creating an open consulting institution that can satisfy the demand for information and help restructure business processes towards sustainability. The authors suggest that players in the financial sector, who can provide competent financial consulting focused not only on financial value but also on supporting social and environmental aspects, play a significant role in offering consulting support. This is particularly important for SMEs, which require support for financial stability while simultaneously implementing sustainable development (aligned with SME characteristics and typical challenges in sustainable development).

The authors see sustainable financial consulting as a comprehensive and important tool aimed at stimulating a holistic approach to creating business value (Jong and Wagenveld, 2023).

Several successful practices and programs for training SMEs are already evident in the consulting and support sector. For example, UNEP promotes eco-innovation among SMEs by selectively providing consulting services related to integrating sustainability into value chains (UNEP, 2024). Similarly, the Cambridge Institute for Sustainability Leadership (CISL), in partnership with the We Mean Business coalition (WMB) and through the SME Climate Hub, offers expert knowledge and practical skills in sustainability (BSR, 2024). Constellation also actively promotes sustainable business development planning and provides resources for internal transformations, such as training, upgrading skills, and developing plans for energy consumption and other resources (Constellation, 2024).

A key role in this context is played by the research of S. Suriyankietkaew and colleagues, who describe that the best results in SME sustainable development are seen when a leadership culture is developed within companies, where the leader influences the team (employees). They provide a case study of a sustainable SME in the tourism sector located in Thailand, demonstrating that a sustainable leader with key competencies in sustainable development can develop and integrate value-oriented practices into company operations, encourage sustainable innovation, values, altruism, accumulate and nurture effective social capital, and demonstrate care for employees or other stakeholders. Such leaders' growing interest in creating and implementing sustainable business models is seen as a key and fundamental perspective in supporting entrepreneurs (Suriyankietkaew et al., 2022).

The (United Nations Industrial Development Organization) UNIDO report notes that support for SME sustainable development is based on specialized educational programs that focus on developing competencies related to sustainable development for managers, providing financing, and creating associations based on sustainable development initiatives, ensuring mutual support of business structures and defining transformational prospects (UNIDO, 2024).

At the same time, only trained and committed leaders to sustainable development values can organize in-house employee training and support comprehensive business model changes.

In Moldova, the "EU for SMEs" program provides financial, educational, and consulting resources for businesses; in terms of consulting and education, the program aims to disseminate information on sustainable business practices, launching production with reduced environmental impact, and increasing energy efficiency (UNIDO, 2024).

4.2. Survey Results on SME Awareness and Practices

However, despite the breadth of existing initiatives, it can be inferred that while educational and training services for SMEs on sustainable development are available, they are not in high demand among SME leaders. This finding is supported by the results of our online survey, in which 85.3% of respondents were employees, and 14.7% were business owners within the SME category. Among the respondents, 55.9% of SMEs were in the service sector, 17.6% in trade, 11.8% in manufacturing, and 14.7% in other sectors. The majority of the surveyed companies have been in operation for more than five years (82.4%), while only 11.8% have been in operation for less than a year, and the remaining 5.9% have been operating for 1–3 years.

The first block of survey questions aimed to determine the level of awareness of SME employees and representatives (owners) regarding the concept of sustainable development. Among those surveyed, only 8.8% were not familiar with the concept of sustainable development; 67.6% had heard of it, and 23.5% were fully familiar with and understood the concept. The primary source of information from which respondents learned about sustainable development was the media (42.4% of cases), followed by educational courses/training (27.3%), colleagues/partners (6.1%), independent research (6.1%), and other sources (18.2%).

In terms of awareness, it is important not just to know the concept of sustainable development but also to understand it adequately. Only 5.9% of respondents rated their understanding as high, while for the majority (55.9%), it was at an intermediate level. The most challenging segment consists of employees and entrepreneurs who demonstrated very low and low levels of understanding of the sustainable development concept, accounting for 8.8% and 29.4% of the total sample, respectively. Despite the fact that a significant portion of respondents considered their understanding of

sustainable development to be low or intermediate, 61.8% defined it as a combination of minimizing negative environmental impact, social responsibility, and economic stability; the remaining 38.2% were roughly equally divided among these categories as defining sustainable development for SMEs.

The second section of the survey focused on exploring current sustainable development practices among SMEs as reported by respondents. Notably, only 45.5% of the respondents overall employ sustainable development practices in their businesses, while 54.5% do not. Among those who do, the most common practices include energy-saving technologies (12.5%), waste recycling (8.3%), responsible resource use (29.2%), employee social programs (20.8%), and other initiatives (29.2%). Additionally, respondents indicated a low level of funding for sustainable development—75% allocate less than 5% of their total budget to these practices, and only 10.7% allocate between 10-20% of their budget (the remaining 14.3% allocate 5-10%).

For 45.2% of the respondents, the primary impact of sustainable business development observed to date has been an improved image; for 12.9%, it has been increased employee satisfaction; another 12.9% reported cost reductions; 9.7% cited the attraction of new clients, while 19.4% noted other effects. A crucial question in the survey concerned the difficulties encountered when implementing sustainable development practices. The most common challenges included a lack of knowledge and information (33.3%), financial constraints (30%), lack of government support (23.3%), and other issues (13.3%). Given the significant role of government support in ensuring sustainable development, respondents were asked to assess the adequacy and quality of such support. The results indicated that 29.4% of respondents were unable to provide an objective assessment (finding it difficult to respond); 41.2% rated it as very poor or poor, 20.6% rated it as satisfactory, and only 8.8% considered it good or very good.

Education and training, according to the respondents, play an important (51.5%) or very important (42.4%) role in the development of sustainable business models (only 6.1% disagreed with this statement). Nevertheless, despite the recognized importance of education and training, 76.5% of respondents had not attended courses or training on sustainable development (only 23.5% had attended). Furthermore, these courses were often not found to be useful (as reported by 27.2% of respondents) or were rated as useful to a medium degree (27.3%), low degree (9.1%), or not useful at all (13.6%).

The third section of the survey was dedicated to examining the interests and preferences of SME employees and owners concerning education in sustainable development. Respondents were asked, "What topics related to sustainable development would you like to study?" The responses were distributed as follows: financial sustainability (29.4%), social responsibility (23.5%), waste management (23.5%), energy efficiency (20.6%), and other topics (2.9%). Another question addressed the aspects that respondents would like to see included in the implementation of sustainable development policies in business; 50% of respondents prioritized financial incentives and subsidies from the government, while the second category was access to educational programs and training. Additionally, 11.8% emphasized increasing awareness and informational support, and 13.7% selected other aspects.

Furthermore, 70.6% of respondents suggested developing and enhancing the utility of social networks and online communities in disseminating information about sustainable development. For 61.8% of respondents, professional conferences and forums were included, while 52.9% supported online courses and webinars; 38.2% favored academic research, and 20.6% preferred publications in industry journals.

5. Conclusions

Based on the survey results, the following key conclusions can be formulated regarding the role of education and training in preparing sustainable business models for SMEs:

Firstly, there is a low level of awareness and understanding of the concept of sustainable development among respondents. Although only 8.8% of respondents were not familiar with the concept, only 5.9% rated their understanding as high, while 29.4% had a low or very low level of understanding.

Secondly, the primary sources of information about the concept of sustainable development are the media (42.4% of respondents) and courses and training (27.3%), leading to the formation of superficial notions about sustainable development and sustainable business models among SMEs. This situation calls for a more active dissemination of specialized knowledge on sustainable development. Additionally, there remains a low level of participation in educational courses on sustainable development (76.5% of respondents did not attend courses or training; only 23.5% attended such courses, and only 27.2% found them useful).

Thirdly, sustainable development is insufficiently implemented in practice, as only 45.5% of respondents use sustainable development practices and simultaneously face financial barriers (75% of respondents allocate less than 5% of their budget to sustainable development). Therefore, respondents have clear ideas about their needs for receiving benefits and specific expectations from educational programs—they expect financial incentives and subsidies from the government (50%) and access to educational programs and training (26.5%). To address educational challenges, 70.6% of respondents suggest developing and using social networks and online communities to disseminate information on sustainable development, and 61.8% support professional conferences and forums.

Currently, there is a significant number of available educational programs on sustainable development aimed at basic awareness or expanding understanding of sustainable business models. At the same time, financial sustainability is an important part of these programs, contributing to the overall popularization of sustainable development. Although education and training services for SMEs on sustainable development exist and are accessible, they are not in high demand among SME leaders, as confirmed by the results of our empirical study.

There is a pronounced need to intensify educational programs and the dissemination of specialized knowledge about sustainable development among SMEs, provide financial incentives and subsidies from the government, and expand access to educational programs and training, and more. This approach lays the foundation for improving the quality of education and training on sustainable development, with a gradual transition to sustainable business models (which are characterized by the ability to create both financial and sustainable value simultaneously). Key channels for developing educational programs on sustainable development include social networks and online communities for disseminating information, as well as professional conferences and forums, which are necessary for enhancing qualifications in the field of sustainable development. Exploring these topics represents a separate area of interest, along with the content of existing programs and the study of sustainable business models and their key parameters.

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Assessing Romania's Ranking in the Digital Quality of Life Index (DQL) 2023

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Abstract

The Digital Quality of Life Index (DQL) assesses digital quality of life based on five essential pillars: internet accessibility, internet quality, electronic infrastructure, electronic security, and digital government. Romania has made remarkable progress in certain areas, such as internet accessibility, but challenges remain in electronic infrastructure and digital government. This article aims to analyze Romania's results in the DQL 2023 and compare them with previous years, highlighting both advancements and challenges in digital development.

Key words: digitalization, cybersecurity, digital economy, internet accessibility, electronic infrastructure

J.E.L. classification: M15, O40, C43, F63

1. Introduction

The Digital Quality of Life Index (DQL) has emerged as a pivotal framework for evaluating how digitalization impacts citizens' well-being across the globe. Developed by Surfshark, the index examines five key dimensions: internet affordability, internet quality, electronic infrastructure, electronic security, and electronic government. Each dimension reflects critical aspects of how digital resources are leveraged to improve quality of life. Romania's 2023 performance in the DQL Index provides a valuable lens for understanding the country's digital development trajectory within a global context, especially in comparison with other European Union (EU) nations.

Romania's position in the 2023 DQL Index reflects both progress and ongoing challenges. Despite being one of the EU's leaders in internet affordability, the country struggles in areas such as digital governance and e-security. This mixed performance highlights the complexities of digital transformation, where advancements in one area may coexist with stagnation or regression in others. Understanding these dynamics is crucial for identifying targeted interventions that can strengthen Romania's digital ecosystem.

In the context of the Digital Government pillar, Romania faces significant hurdles. The 2023 DQL data indicates limited access to e-government services and low adoption rates, particularly in rural areas. These shortcomings are further compounded by disparities in digital literacy and infrastructure development. Comparatively, neighboring countries like Hungary and Bulgaria have made notable strides in digital governance, demonstrating that regional collaboration and policy alignment could offer pathways for improvement.

Global rankings like the DQL Index are not merely diagnostic tools; they also serve as benchmarks for policy-making. Romania's placement underscores the need for strategic investments in technology and human capital to foster a more inclusive digital society. By addressing gaps in

electronic infrastructure and enhancing cybersecurity frameworks, the country could improve its overall DQL ranking, aligning more closely with international standards.

2. Literature review. Preliminary considerations

The Digital Quality of Life Index (DQL) is a comprehensive framework designed to evaluate countries' digital performance across key areas such as internet affordability, internet quality, e-government, e-security, and e-infrastructure. A robust analysis of Romania's ranking in the DQL 2023 requires contextualizing its digital evolution within these pillars. Digitalization has become a critical determinant of socio-economic development, influencing access to services, economic opportunities, and overall quality of life. Romania's position in the index reflects its strengths and challenges in achieving a balanced digital ecosystem.

In recent years, Romania has made progress in improving its internet affordability and quality, positioning itself competitively within the European Union. The cost of broadband and mobile internet in Romania is among the lowest globally, facilitating widespread access to online services. However, while affordability is a key factor, other dimensions, such as speed and stability, remain areas for improvement. Studies emphasize the role of robust infrastructure investments in narrowing the digital divide, a challenge Romania continues to face in rural and underserved areas (European Commission, 2023).

The Digital Government pillar, a focal point of Romania's DQL ranking, highlights the nation's ability to deliver public services through digital platforms. Although Romania has adopted various e-government initiatives, such as electronic filing systems and online public services, its adoption rates lag behind European averages. Factors such as digital literacy and trust in government services impact user uptake, demonstrating the need for more user-centric and secure systems.

Romania's performance in e-security further impacts its DQL ranking. Cybersecurity remains a critical concern, as weak protections deter users from engaging fully with online platforms. The 2023 National Cybersecurity Strategy outlines Romania's plans to strengthen its digital defenses, but gaps remain in public-private collaboration and investment in cybersecurity research.

3. Research methodology

This study employs a mixed-methods approach to assess Romania's ranking in the Digital Quality of Life Index (DQL) 2023. The research combines quantitative data analysis with qualitative contextualization to provide a comprehensive understanding of the factors influencing Romania's performance. The primary dataset for the analysis is the 2023 DQL report, which evaluates countries across multiple dimensions of digital quality of life. Secondary data, such as national statistics and policy documents, are incorporated to triangulate findings and enhance reliability.

The quantitative component involves statistical analysis of Romania's performance in the DQL's five key pillars—Internet Affordability, Internet Quality, Electronic Infrastructure, Electronic Security, and Digital Government. For the Digital Government pillar, specific indicators such as online services accessibility, digital public participation, and government transparency were examined. Comparative analysis was conducted to benchmark Romania's scores against those of other countries in the European Union and globally.

The qualitative component includes a literature review of academic articles, policy papers, and reports on Romania's digitalization initiatives. This provides a contextual background to understand the systemic and policy-related factors influencing the country's DQL ranking. Key themes, such as regulatory frameworks, investment in e-governance, and public adoption of digital services, were identified and explored in depth.

Finally, the methodology acknowledges limitations, such as potential inconsistencies in data reporting across countries and the evolving nature of digital quality of life indicators. These limitations are mitigated through robust data triangulation and sensitivity analysis. The findings aim to inform policymakers and stakeholders about actionable insights to improve Romania's performance in the DQL rankings and foster a more inclusive digital society.

4. Findings

This article delves into Romania's 2023 performance in the Digital Quality of Life Index, with a focus on the Digital Government pillar. By analyzing key indicators and comparing them to regional and global benchmarks, the study aims to provide actionable insights for policymakers and stakeholders. The findings contribute to the broader discourse on digital transformation and its role in fostering sustainable development, emphasizing the interplay between digital accessibility, security, and governance.

Digitalization has become a key element in economic and social development, providing significant opportunities for countries that invest in digital infrastructure and technologies. Romania has made significant strides in the past decade regarding digital connectivity and accessibility. However, Romania's performance in the Digital Quality of Life Index (DQL) varies by domain, underscoring areas where further improvements are needed.

This article aims to analyze Romania's evolution in the DQL 2023 compared to previous years, based on the five evaluated pillars: internet accessibility, internet quality, electronic infrastructure, electronic security, and digital government. The analysis is based on the data presented in Table 1, which summarizes Romania's performance from 2020 to 2023.

Table no. 1. Results of the Digital Quality of Life Index (DQL 2023) Report. Romania

Nr.	DQL pillars	2023		2022		2021		2020	
		rank	index	rank	index	rank	index	rank	index
DQL 2023 RO		14	0.69	34	0.58	34	0.60	39	0.58
1.	Internet affordability	3	0.59	18	0.15	27	0.10	52	0.05
2.	Internet quality	12	0.52	13	0.52	18	0.67	28	0.71
3.	Electronic infrastructure	61	0.73	53	0.71	54	0.70	43	0.72
4.	Electronic security	6	0.97	20	0.87	22	0.87	30	0.78
5.	Electronic government	62	0.65	58	0.66	56	0.66	59	0.63

Source: (DQL 2023). România. <https://surfshark.com/dql2023>

Romania ranks 14th globally in terms of digital quality of life, up 20 places from the previous year. The Digital Quality of Life Index is an annual study that examines and evaluates 121 countries based on the performance of digital services, based on 5 main pillars. In this ranking, Romania stands out for its remarkable accessibility of fixed internet. Now in its 5th edition and produced by Surfshack, the report places Romania in 3rd place for fixed internet. In terms of other indicators, Romania is in 6th place for cybersecurity, 12th place for internet quality and 61st place for digital infrastructure. Although the country achieves good results in some areas, digital infrastructure and digital governance remain significant challenges, ranking 61st and 62nd.

4.1. Internet affordability

Internet accessibility is a critical component of digital quality of life, affecting both the affordability and availability of internet services. According to the Digital Quality of Life Index (DQL) 2023, Romania has made significant strides in improving its internet accessibility, though challenges remain. This synthesis explores the data provided for Romania, comparing it across the years 2020 to 2023, and evaluates the implications for the country's digital landscape.

Table no. 2. Internet affordability (DQL 2023). Romania

Nr.	DQL 2023 RO	2023	2022	2021	2020
INTERNET AFFORDABILITY		3	18	27	52
1	Time to work to afford the cheapest mobile internet	64	18	26	62
2	Time to work to afford the cheapest broadband internet	1	21	22	30

Source: (DQL 2023). România. <https://surfshark.com/dql2023>

In 2023, Romania achieved a remarkable improvement in internet accessibility, ranking 3rd globally, up from 18th in 2022 and 52nd in 2020. This significant leap reflects substantial progress in making internet services more accessible and affordable to its population.

Work Time for Cheapest Mobile Internet: In 2023, Romania ranked 64th, a sharp decline from 18th place in 2022 and 62nd in 2020. This metric measures the average time required to earn enough to afford the cheapest mobile internet plan. The deterioration suggests that while internet access has improved, the affordability of mobile internet has decreased relative to other countries.

Work Time for Cheapest Fixed Internet: Romania excelled in this area, ranking 1st in 2023, compared to 21st in 2022 and 30th in 2020. This improvement indicates that the cost of the cheapest fixed internet plan has become significantly lower, making fixed internet highly affordable for Romanians.

The data shows a mixed but largely positive trend for Romania's internet accessibility:

Improved Fixed Internet Accessibility: Romania's top ranking in work time for the cheapest fixed internet in 2023 demonstrates a successful reduction in costs associated with fixed internet services. This could be attributed to increased competition among internet service providers, government initiatives to expand broadband infrastructure, or both. Enhanced affordability of fixed internet is crucial as it supports broader access to digital services, contributing to overall digital inclusion.

Challenges with Mobile Internet Affordability: Despite improvements in fixed internet accessibility, Romania's declining position in mobile internet affordability is concerning. The significant drop in ranking from 18th to 64th over the past year suggests a growing disparity in mobile internet costs. Possible factors include higher data prices, increased consumption, or slower advancements in mobile network infrastructure compared to fixed internet.

4.2. Internet quality

The Digital Quality of Life Index (DQL) provides a comprehensive evaluation of various aspects of digital life, including internet quality. In 2023, Romania achieved significant improvements in its internet quality ranking compared to previous years. This analysis focuses on the "Internet Quality" pillar, examining Romania's performance in aspects such as mobile and fixed internet speed and stability, as well as investments in improving internet infrastructure.

Table no. 3. Internet quality (DQL 2023). Romania

Nr.	DQL 2023 RO	2023	2022	2021	2020
	INTERNET QUALITY	12	13	18	28
1	<i>Mobile speed</i>	44	39	36	35
2	<i>Fixed speed</i>	7	2	3	28
3	<i>Mobile internet stability</i>	46	19	20	1
4	<i>Fixed internet stability</i>	50	56	35	1
5	<i>Mobile speed improvement</i>	37	40	34	-
6	<i>Fixed speed improvement</i>	21	19	59	-

Source: (DQL 2023). România. <https://surfshark.com/dql2023>

Overall Ranking and Trends: In 2023, Romania's overall ranking in the "Internet Quality" pillar improved to 12th place, up from 13th in 2022 and 18th in 2021. This signifies a notable enhancement in the quality of internet services available in the country. The improvement can be attributed to various factors, including advancements in infrastructure and increased investment.

Mobile Internet Speed: Romania's ranking for mobile internet speed was 44th in 2023, which is a slight decline from 39th in 2022. Despite this decline, the ranking is relatively stable compared to 2021 and 2020. The decline might indicate a lag in the rapid technological advancements seen in other countries or slower progress in network enhancements.

Fixed Internet Speeds: Romania's performance in fixed internet speed has seen significant improvement. The country ranked 7th in 2023, a dramatic rise from 2nd place in 2022 and 3rd in 2021. This improvement reflects Romania's successful investments in upgrading fixed internet infrastructure and technology. The rise from 28th place in 2020 to 7th place in 2023 suggests a robust growth trajectory in fixed broadband capabilities.

Mobile Internet Stability: The stability of mobile internet in Romania has decreased substantially, with the country falling to 46th place in 2023 from 19th in 2022. This decline is particularly concerning as it contrasts with the overall improvement in other areas. The instability

may be due to increased network congestion, insufficient updates in network technology, or regional disparities in mobile internet service quality.

Fixed Internet Stability: Romania's fixed internet stability ranking also saw a decline, with the country positioned 50th in 2023 compared to 56th in 2022. The drop from 1st place in 2020 indicates challenges in maintaining consistent service quality despite overall improvements in speed. This could be a result of scaling issues, infrastructure strain, or maintenance challenges as the user base grows.

Investments in Internet Improvement: Investment in mobile internet infrastructure ranked Romania 37th in 2023, a slight improvement from 40th in 2022. This indicates that while there are efforts to enhance mobile internet services, they are not sufficient to match the pace of technological advancements seen globally.

For fixed internet infrastructure, Romania's investment rank improved to 21st in 2023 from 19th in 2022. This improvement aligns with the notable rise in fixed internet speed, suggesting that investments are translating into tangible benefits for users.

4.3. Electronic infrastructure

Romania's performance in the Digital Infrastructure pillar of the DQL has seen fluctuations over the past few years. This analysis focuses on the specific results for 2023, comparing them with previous years, and provides insights into the factors influencing these changes.

Table no. 4. Electronic infrastructure (DQL 2023). Romania

Nr.	DQL 2023 RO	2023	2022	2021	2020
	ELECTRONIC INFRASTRUCTURE	61	53	54	43
1	Individuals using the internet	75	69	65	58
2	Network readiness	50	45	47	24

Source: (DQL 2023). România. <https://surfshark.com/dql2023>

In 2023, Romania ranked 61st in digital infrastructure, a decline from 53rd in 2022 and 43rd in 2020. This drop highlights a critical area of concern in Romania's digital landscape. To better understand these results, it is essential to break down the key indicators within this pillar: the percentage of people using the internet and the country's readiness in Information and Communication Technologies (ICT).

Internet Usage: The percentage of individuals using the internet is a crucial indicator of digital inclusivity and access. Romania's ranking in this category was 75 in 2023, down from 69 in 2022 and 58 in 2020. This increase in ranking (where a higher number indicates a worse position) suggests that although more people are using the internet, the growth rate has not been sufficient to improve Romania's relative position compared to other countries.

The increase in the number of internet users is positive, but Romania's lagging position highlights issues in bridging the digital divide. Factors contributing to this include disparities in internet access between urban and rural areas and potential socio-economic barriers that limit internet adoption.

Network readiness: Romania's ranking for ICT readiness in 2023 was 50, down slightly from 45 in 2022 but still significantly lower than the 24th position in 2020. ICT readiness reflects how well a country is prepared to utilize and implement new technologies and digital tools. The improvement in ICT readiness indicates some regress in the country's digital strategy and infrastructure. However, Romania's position remains below its previous ranking, suggesting challenges in maintaining and expanding its ICT capabilities. Factors such as investment in technology, training, and infrastructure development play a crucial role in enhancing ICT readiness.

4.4. Electronic security

In the 2023 DQL report, Romania has shown significant improvement in digital security compared to previous years. This synthesis will focus on the "Digital Security" pillar, analyzing Romania's performance in cybersecurity and data protection laws, and discussing the implications of these results.

Table no. 5. Electronic security (DQL 2023). Romania

Nr.	DQL 2023 RO	2023	2022	2021	2020
ELECTRONIC SECURITY		6	20	22	30
1	Cybersecurity	6	27	22	65
2	Data protection laws	VG	VG	VG	VG

Source: (DQL 2023). România. <https://surfshark.com/dql2023>

Cybersecurity: In 2023, Romania achieved a notable ranking of 6th place in cybersecurity, a significant improvement from 27th place in 2022 and 65th place in 2020. This sharp rise highlights Romania's enhanced capabilities and investments in cybersecurity infrastructure and practices.

Romania has implemented a robust national cybersecurity strategy, which includes regular updates to policies and frameworks aimed at combating emerging cyber threats. The National Cybersecurity Strategy of Romania, updated in 2021, outlines comprehensive measures for improving national cybersecurity resilience (National Cyber Security Strategy, 2021). Also, the Romanian government has increased investments in cybersecurity technologies and personnel training. This includes collaboration with international cybersecurity organizations to enhance threat intelligence and response capabilities (European Union Agency for Cybersecurity, 2022).

Data Protection Laws: Romania's data protection laws have consistently been rated as "Very Good" (VG) in the DQL reports for 2020 through 2023. This rating indicates that Romania complies well with the European Union's General Data Protection Regulation (GDPR), which sets high standards for data protection and privacy.

Romania's adherence to GDPR ensures strong protections for personal data, which is critical for maintaining public trust in digital services and preventing data breaches (European Commission, 2023).

The National Supervisory Authority For Personal Data Processing (NSAPDP) plays a crucial role in enforcing data protection regulations and addressing violations. The authority's effective oversight contributes to Romania's high rating in this category (NSAPDP, 2023).

Romania's performance in digital security, as reflected in the 2023 DQL report, demonstrates substantial progress in both cybersecurity and data protection. The country's strong position in cybersecurity and consistent adherence to GDPR underscores its commitment to protecting digital environments and personal data. Ongoing efforts to address emerging threats and enhance public awareness will be crucial for sustaining and advancing Romania's digital security performance in the future.

4.5. Electronic government

Romania's performance in the "Digital Government" pillar has shown some fluctuations over the years, reflecting ongoing challenges and incremental improvements. This synthesis examines Romania's standing in the "Digital Government" pillar as reported in the DQL 2023, exploring the implications of the rankings and suggesting potential areas for enhancement.

Table no. 6. Electronic government (DQL 2023). Romania

Nr.	DQL 2023 RO	2023	2022	2021	2020
ELECTRONIC GOVERNMENT		62	58	56	59
1	Online Service Index	66	58	47	68
2	AI readiness	56	54	50	50

Source: (DQL 2023). România. <https://surfshark.com/dql2023>

According to the DQL 2023, Romania ranked 62nd in the "Digital Government" pillar. This represents a slight decline from its 58th position in 2022 and a deterioration from its 56th position in 2021, although an improvement from the 59th position in 2020. The Digital Government pillar is crucial as it assesses the effectiveness and accessibility of online government services and the country's readiness to leverage artificial intelligence (AI) for governmental functions.

Online Services Romania's position in the online services category fell to 66th place in 2023, compared to 58th in 2022 and 47th in 2021. This decline suggests a slowdown in the development and deployment of digital public services. The ranking of 68th in 2020 indicates that while Romania has made some progress, the rate of improvement has not kept pace with other countries.

The decrease in Romania's ranking for online services may be attributed to several factors, including inadequate integration of digital solutions within public administration, slow adaptation of new technologies, and inconsistent service delivery. To improve its ranking, Romania needs to enhance the efficiency, accessibility, and user-friendliness of its online government services, ensuring that they meet international standards and user expectations.

AI Readiness Romania's position regarding AI readiness improved slightly to 56th in 2023 from 54th in 2022 and 50th in both 2021 and 2020. This indicator reflects the country's preparedness to utilize AI technologies in governmental operations and decision-making processes. Despite a modest improvement, Romania's AI readiness remains below average. The country must focus on developing a robust AI strategy that includes investing in AI research and development, creating a supportive regulatory environment, and fostering partnerships between the government, academia, and the private sector. Enhancing AI capabilities can significantly improve public sector efficiency and service delivery.

Romania's performance in the Digital Government pillar of the DQL 2023 highlights both achievements and areas needing improvement. To enhance its digital government capabilities, Romania must address the challenges identified and implement strategic initiatives that will foster growth and innovation in its digital public services.

5. Conclusions

Romania's performance in the Digital Quality of Life Index (DQL) 2023 highlights both notable progress and areas requiring improvement. One of the country's strongest points is internet accessibility, particularly in fixed internet services, where Romania achieved a top global ranking for affordability. However, the growing disparity in mobile internet affordability points to an imbalance in digital inclusivity. Efforts to reduce the cost of mobile internet should be prioritized to ensure that all segments of the population can benefit from Romania's digital advancements.

In terms of internet quality, Romania's ranking has improved, reflecting successful investments in fixed internet infrastructure. However, the decline in mobile internet stability indicates a need for more targeted investments in mobile network enhancement. The deterioration in this area could hinder the country's ability to fully capitalize on the benefits of digitalization, particularly as mobile connectivity becomes more crucial for businesses and individuals alike.

Romania's challenges with digital infrastructure are evident, as its ranking in this pillar has steadily worsened over the years. While internet usage is increasing, the rate of adoption is insufficient to close the digital divide, especially between urban and rural areas. Enhancing ICT readiness and increasing investments in internet infrastructure are essential to improve the country's digital inclusion and competitiveness on the global stage.

Romania's remarkable progress in electronic security is an encouraging trend. The significant improvements in cybersecurity rankings demonstrate that the country is effectively addressing growing cyber threats. Sustaining this level of performance will require continued investments in cybersecurity infrastructure, workforce development, and international cooperation to combat emerging risks.

Finally, Romania's digital government performance highlights ongoing struggles with the implementation of online services. While AI readiness is improving, the country still ranks relatively low in this area. To boost its digital governance, Romania must focus on modernizing public administration processes, expanding access to digital services, and fostering innovation through AI technologies. By addressing these challenges, Romania can enhance its digital resilience and ensure sustainable growth in the future.

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The Academic Environment's Contribution to the Digital Transition – a Comparative Study of Romania and Eastern Europe

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Abstract

The COVID-19 pandemic significantly increased the use of social communication platforms and electronic information exchange. Technology has thus transformed society and individuals—from how we socialize and communicate to how we govern, work, trade, learn, teach, and research. Digitalization enables universities to fulfill their mission more effectively, simplifying tasks, increasing efficiency, enhancing interaction, conserving resources, and boosting performance. This study aims to identify the efforts made by the Romanian and Eastern European academic environments in initiating, continuing, and implementing institutional digitalization processes after the COVID-19 pandemic.

Key words: Digital transformation, COVID-19 pandemic crisis, higher education institutions

J.E.L. classification: I21, I23

1. Introduction

The COVID-19 pandemic has exposed the global digital divide. In extremely challenging circumstances, it accelerated digital transformation and triggered rapid large-scale changes. Developments that could have taken years took place in just a few weeks. In Romania in 2020, COVID-19 highlighted the lack of adaptation of the domestic digital system to crisis situations. The prolonged lockdown significantly increased the demand for digital public services for citizens and businesses, leading to the need for a national acceleration of digital transformation efforts. In this context, in December 2020, the government established the Ministry of Research, Innovation, and Digitalization, under which the Authority for the Digitalization of Romania (ADR) operates. This institution is tasked with developing strategies and public policies in the field of digital transformation and the information society, coordinating their implementation, and ensuring monitoring and control over compliance with internal and international regulations in these areas. Although among the digital priorities/projects included in the National Investment and Economic Recovery Plan initiated in 2020 are: a) creating an interoperability node, along with identifying and connecting key data registers; b) using electronic signatures in public administration; c) creating a single contact point; d) introducing the electronic identity card; e) migrating public services to a government cloud; f) developing open data systems that allow private sector access to public administration-held data assets; g) investments to increase cybersecurity risk management capacity and connect fiscal electronic cash registers, by October 2024, Romania has made no significant progress.

From reviewing the DESI reports for the period 2020-2022, it is easy to see the progress Romania has made, which, from 26th out of 28th place in 2020, fell to 27th out of 27th (in 2021, the United Kingdom officially left the European Union, so it is no longer included in this ranking). After the COVID-19 pandemic crisis, the fundamental deliverable of investments in the National

Recovery and Resilience Plan (PNRR) for Romania's digital transformation is the Government Cloud. From 2020 to the present, none of the digital projects included in the National Investment and Economic Recovery Plan (PNIRE) have made significant favorable progress, and in the first half of 2024, referring only to the PDURo project that is part of the "Implementation of the Government Cloud Infrastructure" investment, it can be noted that only the implementation contract has been signed.

Digital transformation is an area in which Romania ranks last in Europe despite some notable punctual performances, such as connectivity speed and the existence of innovation and digitalization hubs. Today, there is an urgent need to inform and efficiently manage the actors of digital transformation—beneficiaries, service providers, public authorities, innovation centers—because, although it has been established as a priority, digital transformation is only known and understood at a minimal level by these actors.

Universities, considered engines of digitalization both in Romania and internationally, play an important role in promoting digitalization. In this context, we aimed to identify, at the level of Romanian universities (the top 10 in the national Metaranking) and Eastern European universities, the developments recorded on this winding path of digitalization. The general objective of the paper is to provide an overview of the evolution of innovation capacity after the COVID-19 pandemic period.

2. Theoretical background

In The crisis caused by the COVID-19 pandemic put countries around the world in a situation where there were very few options available for providing education and training outside of digital technology (Wang *et al.*, 2020, p. 946), (Valverde *et al.*, 2021, p. 2). Governments and citizens became aware of the urgent need to improve the use of technology in education and training (Jan, 2020, p. 2), (Edem and Jibril, 2022, p. 2), to adapt pedagogies, and to develop digital skills.

In order to sustainably and effectively adapt the education and training systems of EU member states to the digital era, and as a response to the crisis caused by the COVID-19 pandemic, the EU adopted the Digital Education Action Plan for the period 2021-2027. The following two strategic priorities were set: a) the use of a wide and growing range of digital technologies (applications, platforms, software) to improve and expand education and training; b) acquiring digital skills—knowledge, skills, and attitudes—by all learners, which are necessary to live, work, learn, and thrive in a world strongly influenced by digital technologies. Later, in March 2021, the European Commission proposed a compass to the Digital Decade, aiming to translate the EU's digital ambitions for 2030 into concrete provisions (Decision EU 2022/2481), with clear objectives, structured around four pillars:

- a population with solid digital skills and highly qualified digital specialists;
- sustainable, secure, and high-performance digital infrastructures;
- digital transformation of businesses;
- digitalization of public services.

The 2030 Digital Decade policy program establishes an annual cooperation cycle to achieve common objectives and targets. This governance framework is based on an annual cooperation mechanism involving the Commission and member states. The Commission first outlines the EU's projected trajectories for each goal in collaboration with the member states, which, in turn, propose national roadmaps to achieve the goals.

The cooperation mechanism includes: a) a structured, transparent, and common monitoring system based on the Digital Economy and Society Index (DESI), which allows measuring progress toward each of the 2030 objectives; b) an annual report on the status of achieving the Digital Decade objectives, in which the Commission evaluates progress and provides recommendations for actions to be taken; c) the adjustment of national strategic roadmaps for the Digital Decade every two years, where member states highlight the measures adopted or planned to achieve the objectives for 2030; d) a mechanism to support the implementation of multinational projects. By 2026, the Commission will review the established objectives to account for technological, economic, and societal developments.

In 2024, for the first time, member states presented their national roadmaps to the Commission, detailing the planned actions to achieve the 2030 Digital Decade objectives. The Commission then published specific recommendations for each country, outlining measures to address identified deficiencies related to connectivity infrastructure, cybersecurity, sustainability, and the cloud.

Romania's roadmap demonstrates that the country considers digital transformation important, although it is making only some efforts to reach the goals and targets of the Digital Decade. Among the identified deficiencies, the lack of basic digital skills in over 72% of the population stands out, with the Commission recommending continued efforts to improve workforce reskilling and upskilling, as well as continuous improvement of the quality and relevance of digital skills courses and teaching.

Given this reality, higher education institutions play a central role in the acquisition and development of digital skills. During the COVID-19 period, these institutions were forced to rethink their teaching and learning practices by integrating digital tools into already existing traditional systems [8], with online learning helping students continue their education/training [9], [10]. Initially, it might have been imagined that learning processes would be supported by technology, but it became clear that the effort should rather focus on embedding digitalization skills into the educational process [11]. The challenge lies in identifying those methods, techniques, and tools specific to the digital domain that, when applied to the educational/research/administrative process, can lead to the improvement of higher education activities, becoming a source of inspiration and a model of good practices for other sectors of economic and social life.

3. Research methodology

This study uses the exploratory research method, by consulting strategic plans, operational plans, general strategies, rector reports, digitalization strategies, etc., in the post-pandemic period, 2021 – 2024. These documents were accessed from university websites, aiming to model and measure actions and activities meant to contribute to achieving digitalization targets. As an exception to the temporal scope, some digitalization strategies have been developed for longer time intervals, such as 2021 – 2027.

The research began with the following research question: did the COVID-19 pandemic crisis, through the strategic reexaminations regarding digital transformation conducted at the level of higher education institutions, contribute to the development of their innovation capacity?

When accessing the digitalization solutions of the universities included in our study, we identified the following working hypothesis: the proposed and later implemented changes in the strategic plans/digitalization strategies after 2020 contributed to strengthening the digital expertise of the academic environment.

To validate the working hypothesis, we analyzed the correlations between the strategic objectives assumed by each higher education institution, the targets to be achieved in the corresponding development areas, and the activities proposed to achieve those targets. We chose a comparative study between Romanian universities and Eastern European universities to capture the developments in digitalization tools, methods, and techniques, as well as the skills/competencies that can be acquired by the human resources in the European academic environment, which is generally more developed than the domestic one.

The Romanian higher education institutions selected for the study are the top 9 ranked universities according to the national metaranking for 2023 [OME no. 4299/18 April 2024], with the 10th university being the "Valahia" University of Târgoviște, where the authors are affiliated. The foreign universities were selected based on two criteria: the number of students and specializations similar to those of Romanian universities (see Annex no. 1). It should be mentioned that, although in the national metaranking the 9th university is the Bucharest University of Economic Studies, the failure to meet both of the above criteria at an international level led to the selection of the next university – the Technical University of Cluj-Napoca.

Annex no. 1 Selection of Romanian and Eastern European Universities

No. crt.	Romanian University	Foreign University
1.	„Babeş – Bolyai” University Cluj	University of Ljubljana
2.	University of Bucharest	Jagiellonian University
3.	University POLITEHNICA of Bucharest	Wroclaw University of Science and Technology
4.	“Carol Davila” University of Medicine and Pharmacy Bucharest	Medical University of Lodz
5.	“Iuliu Hațieganu” University of Medicine and Pharmacy Cluj – Napoca	Poznan University of Medical Sciences
6.	„Transilvania” University of Braşov	University of Split
7.	„Alexandru Ioan Cuza” University of Iaşi	Sofia University
8.	West University of Timișoara	Vilnius University
9.	Technical University of Cluj – Napoca	Brno University of Technology
10.	“Valahia” University of Târgoviște	Vytautas Magnus University

Source: Author’s selection

In validating the working hypothesis, our approach aims to select the priority areas, strategic objectives, and activities/initiatives for achieving the proposed objectives, with our primary focus being the identification of how the digitalization process is integrated into the curriculum/research /administrative activities of universities. The priority areas identified in the general strategies/digitalization strategies include: excellence in teaching and learning; support for research – development and innovation; institutional digitalization (Smart Governance); digital services for students; and community and digital presence. For each university, a priority area has been selected, along with the proposed strategic goals and the corresponding activities/initiatives (see Tables 1 and 2), to capture the influence of the digitalization process on the institution's activities.

Table no. 1 Key strategic area, strategic goals, strategic initiatives – European Universities

No. crt.	University	Key strategic area, strategic goals, strategic initiatives
1.	University of Ljubljana	<i>Key strategic area:</i> Develop education, integrated in the home and international environments, to improve creativity, innovation, critical thinking and social responsibility. <i>Strategic goals:</i> 1. Develop and update study programmes (<i>Strategic initiatives:</i> Implement IT – supported system solutions that simplify electivity and interdisciplinarity: a unified information system for the preparation of timetables at the UL, digital and professional support for various e-teaching techniques – e.g., recorded lectures, virtual campuses, etc.); 2. Promote teaching excellence (<i>Strategic initiatives:</i> technologically supported teaching and learning – digitalisation).
2.	Jagiellonian University	<i>Key strategic area:</i> A sustainable research university, a leading research centre recognised in Europe and the world. <i>Strategic goals:</i> Organization of the research process, based on modern infrastructure, digital solutions, efficient organisation and a scientist-friendly research system. (<i>Strategic initiatives:</i> Develop and implement a database and software license purchase policy, including the coordinated purchase of key tools and digital resources; Modify, simplify, adapt and continue digitalising administrative procedures related to research management and continuously develop the competences of administrative, engineering and technical staff; Update scientific policy, taking into account the research activity of the University and research and innovation strategy within Una Europa and other university networks.)
3.	Wroclaw University of Science and Technology	<i>Key strategic area:</i> Cooperation with the environment. <i>Strategic goals:</i> 1. Strengthening partnerships with the business sector to enhance research and education vital to technological progress and the development of both local and global economies – this includes engaging in collaborative research and inviting partners to contribute to shaping the educational offer; 2. Facilitating technology transfer and the commercialization of research results, and building a supportive network around the University to foster innovative entrepreneurship and support new start-up or spin-off projects, especially in the realm of deep tech (<i>Strategic initiatives:</i> Creating and expanding partner networks linking academic centres, business, and regional self-government, based on collaboration, engagement, and trust – for example, the consortium “Institute of Technology and Innovation Highway” or the macro cluster “Technologies in Public Security”; Advancing the activities of Wroclaw Centre for

		Networking and Supercomputing, as well as establishing and developing research centres focused on technology innovation.)
4.	Medical University of Lodz	<i>Key strategic area:</i> Management and organisational development. <i>Strategic goals:</i> Support of the employees' engagement and effectiveness. (<i>Strategic initiatives:</i> Increasing the competences of the managerial staff in the area of management, leadership and innovative approach promotion in the employees; Developing competences of the teaching staff.
5.	Poznan University of Medical Sciences	<i>Key strategic area:</i> Educating medical personnel for the country, Europe and the world. <i>Strategic goals:</i> 1. Revision and adjustment of curricula taking into account increased student freedom in the implementation of the curriculum and greater use of medical simulation techniques and distance learning methods; 2. Internationalisation of education at the PUMS. (<i>Strategic initiatives:</i> Increasing the integration of clinical and primary teaching; Systematic expansion of the database of e-learning resources within the PUMS course repository; Increasing student engagement in the learning process; Optimizing the principles of student learning in the area of practical skills outside of clinical units; Implementing modern methods of evaluating the quality and effectiveness of the educational process; Organization of postgraduate courses using distance learning techniques and methods, including English; Training for didactic staff aimed at improving the quality of education with the use of modern distance learning techniques; Supplementing the clinical didactic database with systems that enable distance learning.)
6.	University of Split	<i>Key strategic area:</i> Science, art and innovation. <i>Strategic goals:</i> Open science and digital transformation. (<i>Strategic initiatives:</i> Build digital transformation strategy for research and development; Establish a strategic European digital innovation hub in blue-green economy through networks of all sectors and regions.)
7.	Sofia University	<i>Key strategic area:</i> Scientific research and development. <i>Strategic goals:</i> 1. Improving the environment for science and innovation and motivating researchers. (<i>Strategic initiatives:</i> Improve access to modern scientific infrastructure, scientific databases and up-to-date information sources; Supporting researchers' work processes through convenient and efficient systems based on modern technological solutions; Implement a new pay system that is attractive, fair and flexible, and helps to attract and retain talent.) 2. Improving the training and career development of researchers. (<i>Strategic initiatives:</i> Conducting periodic surveys of researchers to explore their needs for additional knowledge and skills; Stimulating a diverse research career, including experience in other sectors and abroad, including collaboration with industry.) 3. Effectiveness and efficiency of human resources support activities in science and innovation. (<i>Strategic initiatives:</i> Enhancing the capacity of the Research and Projects Unit to provide effective expert support and advising the researchers in the preparation of science and innovation projects; Introduction of periodic survey among the academic staff as a tool for continuous improvement of activities in support of researchers and for the formation of the image of Sofia University "St. Kliment Ohridski" as an excellent place to work.)
8.	Vilnius University	<i>Key strategic area:</i> Sustainable. <i>Strategic goals:</i> 1. Motivated employees and engaged students. (<i>Strategic initiatives:</i> Increased evaluation of job and studies involvement as well as satisfaction with the organization, work, departments compared to the evaluation of 2020). 2. Infrastructure that meets the future needs. (<i>Strategic initiatives:</i> Development of the Sauletekis and Santana VU campuses, HSS infrastructure; Improvement of the effectiveness of operational support –community satisfaction with operational support at least 4 out of 5; Green University: 50% emission reduction, research and education). 3. Financial growth through income diversification. (<i>Strategic initiative:</i> A change of 25% in the revenue from R&D solutions and services and lifelong learning activities compared to the previous five-year period.)
9.	Brno University of Technology	<i>Key strategic area:</i> Develop competencies directly relevant to life and practice in the 21 st century. <i>Strategic goals:</i> 1. Support the building of infrastructure for interactive education methods of student integration. (<i>Strategic initiatives:</i> Analysis of current interactive teaching equipment of faculties and components; subsequent retrofitting of components for this type of teaching.) 2. Increase the use of distance learning methods in full-time study programmes. (<i>Strategic initiatives:</i> Preparation of methodological materials for distance forms of teaching and testing; support and motivation for teachers in creating teaching aids for distance teaching of individual subjects; Analysis of existing software equipment for remote testing of knowledge, acquisition of other

		necessary equipment; Preparation of methodological materials for using the acquired equipment.)
10.	Vytautas Magnus University	<i>Key strategic area:</i> University impact on societal development. <i>Strategic goals:</i> 1. Establish the identity of the University. (<i>Strategic initiatives:</i> Create digital and social progress and implement sustainable application and societal transformations through the implementation of T4E activities; Shape the society of the future by increasing learning opportunities through open studies.) 2. Aspire to community sustainability and synergy by respecting the community's diversity and the personal autonomy of its members. (<i>Strategic initiatives:</i> Prepare a module of non-formal physical and distance Lithuanian studies and establish VMU's leadership in the field of non-formal Lithuanian education.) 3. Seek leadership in the training of agricultural specialists and in the development of Agriculture, Forestry, Aquaculture and Rural Development Policies. (<i>Strategic initiative:</i> Initiate, develop and implement interdisciplinary study programs for sustainable development, agribusiness and public interest in bio economy, digitalization of agriculture, bio systems management, as well as continuing education and training projects.)

Source: Author, by using general strategies or digitalization strategies information's

Table no. 2 Key strategic area, strategic goals, strategic initiatives – Romanian Universities

No. crt.	University	Key strategic area, strategic goals, strategic initiatives
1.	„Babeş-Bolyai” University Cluj	<i>Key strategic area:</i> Relationship with society. <i>Strategic goals:</i> 1. Administrative innovation. (<i>Strategic initiatives:</i> Restructuring and redefining workflows, with a focus on simplification and de-bureaucratization.) 2. Efficient use of existing spaces. (<i>Strategic initiatives:</i> Auditing the existing space; Optimizing space usage.) 3. Digital transformation. (<i>Strategic initiatives:</i> Continuing the implementation of already initiated measures; Teaching and research activities supported by technology and digitalization.) 4. Sustainable university, environmentally friendly. (<i>Strategic initiatives:</i> Continuing the implementation of measures already initiated under the UBB Goes Green program.)
2.	University of Bucharest	<i>Key strategic area:</i> Innovation, adaptation, and digital transformation. <i>Strategic goals:</i> 1. Increase the degree of internationalization. (<i>Strategic initiative:</i> Ensuring support and assistance services for publishing: translation, proofreading, editing, consulting.) 2. Encourage efficient innovation, adaptation to environmental changes, and particularly to labor market shifts. (<i>Strategic initiatives:</i> Activities aimed at increasing the number of participants in UB innovation promotion events; Adopting and implementing measures to increase the number of patents contracted through agreements with third parties; Conducting activities to increase the number and value of projects run by the ABACUS innovation hub.) 3. Digital transformation of academic and administrative processes. (<i>Strategic initiatives:</i> Introduction of new study programs with a digital component or revised from the perspective of digital transformation; Operationalization of electronic registry – one stop shop; Electronic circulation of documents and electronic archive.)
3.	University POLITEHNICA of Bucharest	<i>Key Strategic Area:</i> Community and Digital Presence. <i>Strategic goal:</i> Strengthening the UPB community and its relationships with society through digital technologies, and increasing the university's presence and visibility nationally and internationally. (<i>Strategic Initiatives:</i> Improving the university website, centralizing, and providing direct access to all digital resources on the site, and facilitating access to the educational offerings; Offering the community online learning modules tailored to different categories of users; Transforming UPB into a Smart Campus, inspired by the Smart City concept.)
4.	“Carol Davila” University of Medicine and Pharmacy Bucharest	<i>Key Strategic Area:</i> Scientific Research. <i>Strategic Goals:</i> 1. Strategies to Increase the Visibility of University Research. (<i>Strategic initiatives:</i> Presenting research activities on the university website through a dedicated portal, highlighting fields, disciplines, researchers, teams, projects, and results achieved; Encouraging publication in high-impact journals. 2. Implementing Research Activities to Support Precision Medicine Research. (<i>Strategic initiatives:</i> Investing in equipment and bioinformatics technologies for processing experimental “big data”; Enhancing the research capacity of the center. 3. Infrastructure Development for the Genomics

		Center. (<i>Strategic Initiatives</i> : Expanding research infrastructure with state-of-the-art equipment; Supporting innovation and technology transfer.)
5.	"Iuliu Hațieganu" University of Medicine and Pharmacy Cluj – Napoca	<i>Key Strategic Area</i> : Innovation, Adaptation, and Digital Transformation. <i>Strategic goals</i> : 1. Establishing a Strategic Framework for Supporting and Promoting Digitalization at UMFCN. (<i>Strategic Initiatives</i> : Identifying opportunities to enhance access to technology for educational and research programs within the university; Encouraging research projects focused on developing IT solutions for e-health/m-health and integrating these solutions into UMFCN's IT platforms.) 2. Accelerating the Digitalization of Teaching and Research Activities at the University. (<i>Strategic Initiatives</i> : Equipping disciplines with IT tools and licenses for both in-person and online activities; Operationalizing and modernizing software for evaluating teaching staff; Implementing and modernizing a program for managing and reporting research projects and outcomes.) 3. Accelerating the Digitalization of University Support Processes. (<i>Strategic Initiatives</i> : Implementing and operationalizing an electronic document management platform; Operationalizing software for electronic inventory management; Modernizing the student management system software; Updating software for housing and scholarship management.)
6.	"Transilvania" University of Braşov	<i>Key Strategic Area</i> : Internationalization of the University. <i>Strategic Goal</i> : Increasing the level of internationalization at the university. (<i>Strategic Initiatives</i> : Establishing and activating the International Advisory Council; Developing at least one program in each faculty taught in foreign languages; Supporting the improvement of language skills for academic staff, administrative personnel, and students; Encouraging annual participation of each faculty member and researcher in at least one scientific event abroad and funding university-specific programs for training/documentation/work placements abroad, as well as for developing international educational and scientific cooperation; Promoting the involvement of international experts in the university's teaching, research, and administrative processes through funding for specific dedicated programs.)
7.	"Alexandru Ioan Cuza" University of Iaşi	<i>Key Strategic Area</i> : Excellence in Education. <i>Strategic Goals</i> : 1. Strengthening the E-Learning System and Increasing the Use and Diversification of Information and Communication Technologies in the Educational Process. (<i>Strategic Initiatives</i> : Expanding the use of the Moodle platform across all faculties, for both distance learning (ID/IFR) programs and components of online teaching activities for full-time (IF) students; Increasing the utilization of technologies in the design and delivery of teaching content; Using online counseling platforms such as ICARD and www.career-modules.eu ; Providing free training sessions and workshops for students; Developing digital skills in the humanities through the PNRR project, code 127544578, titled "Framework for the Sustainable Development of the University's Digital Component-Euaic." 2. Modernizing Data/Voice Infrastructure. (<i>Strategic Initiatives</i> : Replacing and upgrading data/voice infrastructure in most UAIC spaces; Providing ITC resources for laboratories and educational facilities.) 3. Continuous improvement of material resources. (<i>Strategic Initiatives</i> : Ongoing enhancement of facilities for teaching and research activities, as well as developing new investment projects for expansion; Ensuring a transparent procedure for allocating resources for students, such as housing, scholarships, and material support.)
8.	West University of Timişoara	<i>Key Strategic Area</i> : Performance oriented management. <i>Strategic Goals</i> : Participatory, goal-centered management that drives change. (<i>Strategic Initiatives</i> : Integrating e-management systems and developing new modules for these systems across all managerial and administrative levels; Improving secretarial and technical-administrative services through full digitalization and encouraging accountability for the quality-of-service delivery.)
9.	Technical University of Cluj – Napoca	<i>Key Strategic Area</i> : Digitalization of Educational and Administrative Processes to Enhance Institutional Quality and Performance. <i>Strategic Goals</i> : 1. Development of the "Digital Innovation Platform" in Four Main Areas: e-Education, e-Research, e-Administration, and e-Student. (<i>Strategic Initiatives</i> : Implementing the e-learning project by developing a teaching-learning-assessment platform, creating and/or improving related teaching materials, and digitalizing support processes; Implementing the e-research project by developing a platform for managing and

9.	Technical University of Cluj – Napoca	conducting scientific research projects and digitalizing support processes; Implementing the e-administration project by expanding the capabilities of the electronic registry, exclusively using electronic signatures for all internal documents, and digitalizing processes within administrative departments/offices to enable efficient, fast, and transparent workflows with minimal reliance on paper-based documents; Implementing the e-student project by developing a platform for managing services and facilities specific to student activities, such as online admissions, issuing certificates, resolving requests, etc.) 2. Strengthening the "Virtual Campus UTCN" as a Hub for the University's Digital Transformation. (<i>Strategic Initiative</i> : Identifying the human, material, financial, and logistical resources needed to strengthen the "Virtual Campus UTCN" Department and operationalizing the "Digital Innovation Platform.")
10.	"Valahia" University of Târgoviște	<i>Key Strategic Area</i> : Optimization of Administrative Management. <i>Strategic Goals</i> : 1. Improving Human Capital Management through a Transparent Process Based on Performance Criteria for Promoting Faculty, Researchers, and Teaching-Assistant/Administrative Staff. (<i>Strategic Initiative</i> : Optimizing communication and action processes between various entities within the university structure, ensuring high-performing staff and developing IT infrastructure.) 2. Developing a Marketing Strategy and Tools to Enable the University to Communicate Effectively with Relevant Higher Education and Research Institutions and Associations. Promoting Entrepreneurship and Educational Services in the Field. (<i>Strategic Initiative</i> : Ensuring IT infrastructure for promoting e-learning teaching materials and online student assessment methods.) 3. Developing a Marketing Strategy and Tools to Enable the University to Communicate Effectively with Relevant Higher Education and Research Institutions and Associations. Promoting Entrepreneurship and Educational Services in the Field. (<i>Strategic Initiatives</i> : Modernizing and updating the university website and promoting the institution on online social platforms.)

Source: Author by using general strategies or digitalization strategies information's

4. Findings

After the COVID-19 pandemic, the digitalization process has rapidly developed both in Eastern European universities and in the Romanian educational landscape. Based on the analysis of strategies, numerous actions promoting/implementing digitalization have been identified in the following priority areas:

- *For education*, notable actions identified include: improving digital learning environments, learning and content management platforms, including the development of personalized teaching techniques that increase student motivation; developing digital courses or course modules available to university students; updating existing programs by revising course syllabi with a focus on digital competencies and emerging professions; developing learning communities and collaborative learning, analyzing discussions in learning communities based on artificial intelligence techniques; assistive technologies for students with special needs; developing digital assessment resources; intelligent learning outcome analysis systems (learning analytics); acquiring equipment for recording courses and interactive teaching methods; increasing the number of rooms equipped with videoconferencing facilities; continuous training for faculty and students in digital competencies required for digital transformation/digital education.

- *For research, development, and innovation*, actions include: multimedia presentations and virtual tours of research centers at universities; creating a virtual Marketplace linking university research outcomes with the business environment; developing fully digitalized entrepreneurship and innovation centers; developing research and technology transfer centers; presenting research activities on the university website (portal), marking fields, disciplines, researchers with their activity teams, projects, results, and publications; encouraging publication in high-impact journals from quartiles 1 and 2; promoting and supporting the organization of large-scale scientific events.

- *For institutional digitalization*, actions include: transferring administrative processes online in the form of document flows for administrative simplification through digitalization; reorganizing university IP address classes to reduce cybersecurity vulnerabilities; creating an electronic registry;

building/accrediting an electronic archive to simplify administrative processes through digitalization; efforts to implement the European Student Card Initiative; implementing an SSO (Single Sign-On) system across the university for digital integration; developing integrated digital institutional management systems, including a Building Management System.

- *For digital services for students*, actions include: providing digital support for professional and personal development; learning performance analysis tools (learning analytics for individual paths); chatbot interfaces for various university services and helpdesk; personalized tutoring based on artificial intelligence techniques; digitalizing timetables and providing access to schedules via mobile devices; mobile navigation assistance on university premises; equipping or resizing data centers to meet institutional needs; Smart Campus, City in City; providing digital versions of services such as the Career Counseling Center, Student Entrepreneurship Center, Culture, Volunteering, Sports, and Recreational Activities Center; digital access to dormitories, cafeterias, and recreational centers.

- *For community and digital presence*, actions include: offering online learning modules for different user categories: a) prospective candidates: preparation for admission and initiation in specific topics of interest; b) educational services for companies, civil society, and public administration employees; c) the general public – videos promoting the university's technological results; automatic monitoring of media presence and social platform engagement; expanding the university's Alumni platform with various digital services.

By reviewing the correlations between the strategic objectives assumed by universities, the targets in the corresponding development areas, and the proposed activities to achieve these targets, it can be concluded that the changes proposed and later implemented in strategic plans/digitalization strategies after 2020 have contributed to strengthening the digital expertise of the academic environment and increasing their innovation capacity.

5. Conclusions

An open and high-performance digital education ecosystem in the EU can contribute to attracting and supporting excellence worldwide, especially as global competition for talent and innovation accelerates. It can help enhance innovation performance within the EU and its member states. By rapidly adapting university curricula, shifting research and administrative activities to meet the requirements of digital transformation, universities can become sources of inspiration and models of best practices for other sectors of economic and social life.

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Shadow Economy and Bibliometric Analysis: What Is the Trend in Current Times ?

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Abstract

Through VOSviewer bibliometric analysis, the changing academic focus on the link between technological progress and shadow economy is examined. The study highlights the broad research areas, emerging themes, and gaps in this interdisciplinary topic by mapping keyword co-occurrence networks. Digitalization, corruption and tax evasion have recently received a lot of attention, but the results show that digitalization and technology have always had an impact on informal economic activity. The report also shows that people are becoming concerned about how shadow economy affects the environment, particularly in terms of carbon emissions and sustainable development. However, there are substantial knowledge gaps due to weak links between shadow economy, public policy and productivity. Policy interventions and the wider economic consequences of informal activity could be the subject of future research. In an increasingly digitized and interconnected world, the importance of taking a comprehensive approach to understanding the shadow economy is highlighted.

Key words: shadow economy, technology, digital, innovation

J.E.L. classification: O17, E26

1. Introduction

Nowadays, the scientific community and ordinary citizens alike show a growing interest in shadow economy. The phenomenon is perceived as a combination of uncontrolled economic activities that take place in parallel and in the shadow of the legal economy. This includes a wide range of informal, undeclared and criminal economic activities which, although operating outside official control, contribute to employment, consumption and production. However, this sector limits tax collection, falsifies official data and can hinder progress in governance and the economy (Munteanu et al., 2024, p. 4). The relationship between technology and the underground economy has grown with the development of the technological and digital side. Not only do technologies such as digital payment systems and blockchain provide means to combat shadow economic activity, but they also provide new opportunities for informal transactions.

Using bibliometric analysis, the paper analyzes the intensity of this interest in recent years. The program used is VOSviewer. This is a software program that helps to visualize and explain the structure of research fields by mapping co-authorship networks, keywords and citation patterns (Aivaz & Petre, 2024, p. 6). The study uses keywords such as "shadow economy" and "technology", to assess the degree of engagement of the academic community in this topic. It also identifies specific subfields or elements that receive the most attention from researchers.

Trends in research on the relationship between technological innovation and shadow economy will be presented in this study, comparing areas that have received significant attention with those that remain underexplored. The general hypothesis proposed is that scientific interest, in how technology connects with the underground economy, increases with the growth of the digital

economy and rapid advances in technology. The objective of the analysis is to identify the level of interest among the scientific community, to identify thematic areas of focus and to determine whether this topic has become a "heated discourse" in contemporary research.

2. Literature review

The underground economy, comprising economic activities that evade official regulations, has strong ramifications on national economies. The phenomenon is influenced by various factors, especially economic ones, such as taxes and the unemployment rate, but also political ones, such as the quality of governance, or social ones, such as culture and even personal happiness (Clement et al., 2023, p. 829; Davidescu et al., 2022, p. 685). The problem of informality is also complicated by the fact that these effects differ from one region to another (Davidescu et al., 2022, p. 686). As e-government activities can increase transparency and decrease informality, technological advances have significant repercussions on the shadow economy. However, the question arises whether the benefits brought by technological innovations, in the fight against shadow economy, are really significant, or the shadow economy has just gained a new branch in which to operate. Chacaltana et al. (2024, p. 21) and Kireenko et al. (2018, p.2) found that while technology promotes transparency, it can also facilitate informality through freelance work, resulting in digital economies that are both formal and informal.

As more and more people shop online, a new underground economy has formed where customers put convenience ahead of compliance. According to Gaspareniene et al. (2016), legislators face new obstacles in the form of an unregulated digital industry. To address these informal practices, they need to create legal frameworks, educate consumers and enforce legislation (Gaspareniene et al., 2016, p. 503). In areas such as West Africa, where the development of ICT (Information and Communication Technology) in line with the SDGs (Sustainable Development Goals) has revolutionized the informal sector, shadow economy has also been deeply affected by ICT (Ajide & Dada, 2022, p. 10).

By providing information on topic groups and publication patterns, bibliometric analysis has become an invaluable tool for tracking research trends in shadow economy studies. Analyzing through the VOSviewer program, Zolkover and Terziev (2020) were able to uncover recurring themes in the underground economy literature, including tax evasion, corruption and urban informality (Zolkover & Terziev, 2020, p. 109). In their proposal for a bibliometric research framework, Öztürk et al. (2024) extend this approach by emphasizing the importance of structured bibliometric methodologies in effectively capturing complex research landscapes and improving methodological rigor (Öztürk et al., 2024, p. 3341). Starting from these techniques, several authors offer various solutions by performing bibliometric analyses, defining the fundamental procedures and tactics needed to investigate complex aspects such as the shadow economy and its interaction with other aspects of the economy (Passas, 2024, p. 1018; Matei & Aivaz, 2023, p. 986; Florea, Aivaz & Vancea, 2023, p. 72; Aivaz, Florea & Munteanu, 2024, p. 7).

Shadow economy has recently attracted more attention from academia around the world. The top three publishing nations in this area are India, the US and the UK. The transition from informal to formal economies and the impact of digital innovations on this transition are becoming increasingly important themes in published works (Timofte & Coca, 2020, p. 35). In addition, Nica et al. (2024) conduct a bibliometric analysis of shadow banking and financial contagion, showing that discussions of the underground economy often focus on systemic risk and regulatory challenges. This is especially true in research conducted after the 2008 financial crisis (Nica et al., 2024, p. 12).

Taking all these aspects into account, the literature shows that the shadow economy is multifaceted and complicated, with influences from the economy, society and technology. This dynamic, the grouping of research themes and the tracking of changes in academic orientation over time, benefited from important help from bibliometric analysis. This analysis highlights how technology influences informality and how bibliometric research provides a framework for understanding the underground economy in the context of a dynamic economic and technical environment.

3. Research methodology

This study analyzes the relationship between technological improvements and shadow economy using the VOSviewer program. Co-citation networks, topic clusters, and keyword co-occurrence patterns are all examined in this article. Because bibliometric analysis is a quantitative tool to find patterns in a large number of published scientific works, it is increasingly used to study transdisciplinary topics (Passas, 2024, p. 1018; According to Öztürk et al., 2024 , p. 3341). Relevant literature was collected using the E-nformation platform. The database accessed is Scopus, to ensure relevance to current technological and economic contexts. The selected period was from 1981 to 2023 inclusive. Eligible articles were further screened to ensure they were consistent with the study objective. The collection was narrowed using keywords such as "economy", "shadow" and "technology".

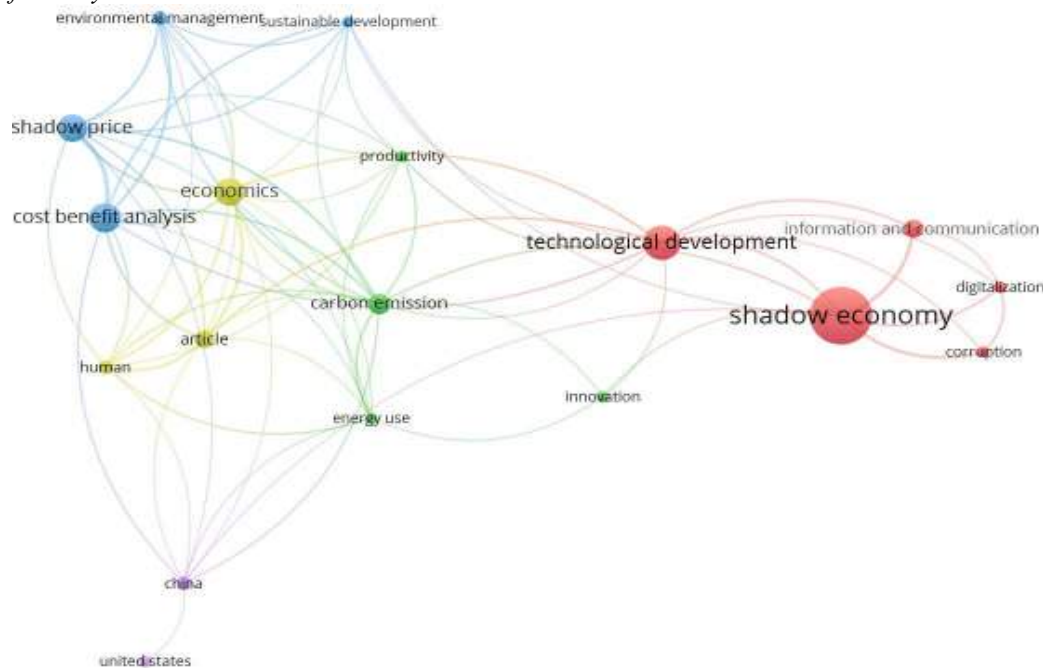
Using descriptive and network-based bibliometric methodologies, this study showed clusters of recurring themes and provided a quantitative analysis of research productivity. Academia is increasingly interested in how technology intersects with shadow economy, as shown by Clement et al. (2023, p. 829), Chacaltana et al. (2024, p. 21), Gaspareniene et al. (2016), Ajide & Dada (2022, p. 10) and others. This is particularly true in terms of how digital tools influence informal economies and the regulatory issues that arise in different global contexts. By integrating performance analysis and scientific mapping, this study looks at the development of the field and areas of interest. By identifying the lack of research and orientation studies, it lays the groundwork for future research on the complex interactions between technological innovation and informality (Nica et al., 2024, p. 12).

4. Findings

Through the E-nformation platform, the Scopus database was accessed. A first search of the keywords "economy" and "shadow", resulted in a number of 3,418 scientific papers. This was anticipated, with shadow economy already being a niche topic. Next, the keyword "technology" was added, thus resulting in a number of 245 scientific papers. This number was further filtered by limiting the period to 2023 as the final year and selecting only scientific articles already published that are in English. The final number was 139 scientific papers available for analysis. By comparison, the combination of the keywords "economy", " shadow" and "digital", after filtering, resulted in a number of 46 available scientific papers, a number too small to be relevant for the proposed analysis. Also adding more than three keywords reduces the number of scientific papers available for this topic too much. The minimum number of occurrences for a keyword was set to 5. The resulting keywords were processed to avoid their duplication, resulting in a total of 18 relevant keywords.

In the graph generated with VOSviewer (Fig. 1), a network of keywords can be observed that reflects the links between "shadow economy" and "technological development". Terms like "digitalization," "corruption," and "carbon emission" have connections to the theme of the underground economy, suggesting an interdependence between technological progress and factors influencing the informal sector. The grouping of words such as "cost-benefit analysis" and "sustainable development" highlights aspects related to the assessment and impact on the shadow economy and sustainable development. The keywords were organized into 5 clusters, in which one cluster contains only the terms "china" and "united states".

Figure no. 1 Bibliometric analysis, keywords "economy", "shadow", "technology", minimum 5 occurrences for a keyword



Source: Own processing based on the database on E-nformation and VOSviewer

As can be seen in Fig.1 and Tab.1, the map has 5 clusters, in which the relevant keywords resulting from the analysis are grouped. For a clearer visualization of the composition of the clusters, they were presented in a tabular form (Tab.1.).

Table no. 1 Summary of the co-occurrence network of VOSviewer terms - keywords "economy", "shadow", "technology", minimum 5 occurrences for a keyword

Cluster 1	1.corruption 4.shadow economy	2.digitalization 5.technological development	3.information and communication technology
Cluster 2	1.carbon emission 4.productivity	2.energy use	3. inovation
Cluster 3	1.cost benefit analysis 4.sustainable development	2.enviromental management	3.shadow price
Cluster 4	1.article	2.economics	3.human
Cluster 5	1.china	2.united states	

Source: Own processing based on the database on E-nformation and VOSviewer

The first network view in VOSviewer (Fig. 1.) presents a bibliometric map of the shadow economy and the relationships between economic, environmental and technological ideas. This chart provides insight into the current state of research on the intersection of the shadow economy and technological progress. It also helped reveal burning matters, emerging themes, and uncharted territories.

Central research ideas and current topics are represented by the relationship between the notions of "shadow economy" and "technological development". These are obvious pressing concerns in the current research, as they emerged as major nodes. There is great curiosity about the effects of new technologies on the informal or uncontrolled economy. Experts are concerned, above all, with how innovation and digitalization are changing the underground economy. In other words, which way was the balance leaning, rather towards preventing and combating the shadow economy or rather towards facilitating access to new sectors. As digital tools become more pervasive in everyday life globally, the consequences of technology on the underground economy have broad political implications, making this a heated discourse.

"Carbon emissions" and "energy consumption" appear to be related to "technological development" and the "shadow economy", indicating a growing multidisciplinary interest in the effects of the shadow economy on environmental indicators. The environmental costs of unregulated operations, which frequently circumvent sustainable norms and regulatory frameworks, are becoming increasingly visible, as this link shows. Although research into the environmental effects of the underground economy is ongoing, the focus so far has been on technical rather than environmental aspects.

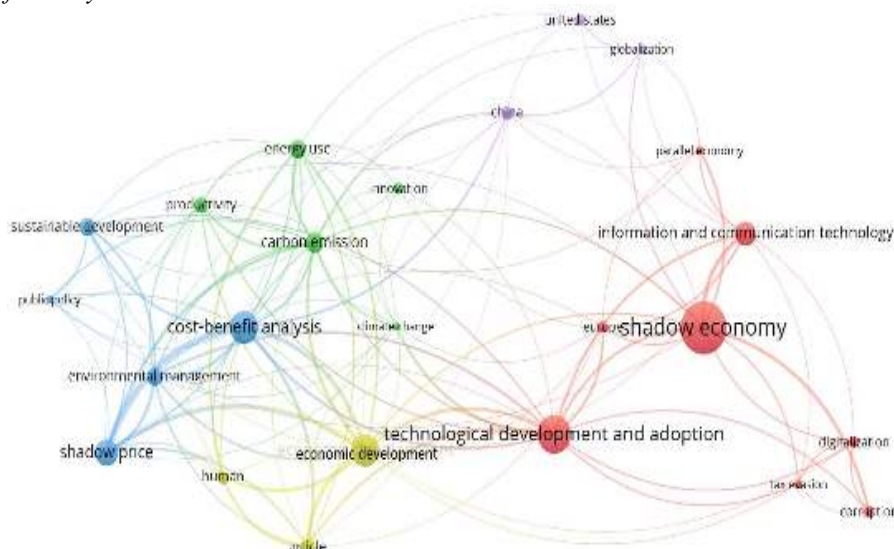
Among the group of new ideas and disconnected topics are the grouping of "carbon emissions" and "energy consumption" with "sustainable development", "environmental management" and "productivity". They demonstrate the emergence of a new field of study that combines aspects of sustainable development with the shadow economy. Thus, research no longer focuses on direct costs, but on indirect ones, such as the effects on resource management and the environment caused by underground economic activity. Although sustainability is becoming increasingly important, it is still in its early stages and has not reached the same level of attention as technology-related themes, as shown by its somewhat weaker relationship with major nodes.

Finding missing pieces of information and unexplored relationships is a necessary thing in scientific research. There is a wealth of information about technical progress, but it seems that certain important areas are still unexplored. For example, "public policy" and "cost-benefit analysis" are mentioned but not specifically related to the main ideas. There appears to be a lack of studies on specific policy interventions and cost-benefit assessments of shadow economy management, even though the relationship between the phenomenon and technology has been extensively studied. Research is needed on the advantages and disadvantages of technological solutions for the shadow economy, as well as studies quantifying the economic benefits and costs of these interventions.

The visualization also draws attention to a possible knowledge gap regarding the relationship between the "shadow economy" and more systemic economic effects such as productivity. Although productivity is addressed, it appears to be peripheral to the main points, suggesting that research on the effect of the underground economy on macroeconomic productivity may be lacking. Particularly with regard to informal employment and undeclared economic activity, future studies could examine the effects of shadow economy on overall economic growth, efficiency and productivity.

Although the relationship between the shadow economy and technological growth is a popular research topic, the bibliometric analysis of this view indicates that there is a chance to extend the examination to other important areas. To better inform policy decisions, further studies can examine the effectiveness of digital tools in reducing shadow economy activity and provide evidence-based cost-benefit assessments. The literature would also benefit from a deepening of the negative effects of the shadow economy on the environment, such as the carbon footprint and energy inefficiency.

Figure no. 2 Bibliometric analysis, keywords "economy", "shadow", "technology", minimum 4 occurrences for a keyword



Source: Own processing based on the database on E-nformation and VOSviewer

As can be seen in Fig.2 and Tab.2, the map also has 5 clusters , in which the relevant keywords resulting from the analysis are grouped. In contrast to the first analysis (Fig. 1 and Tab. 1.), the second analysis outlined the composition of the clusters in a welcome complementary manner. For a clear visualization of the composition of the clusters, they were also presented in a tabular form (Tab.2.).

Table no. 2 Summary of the co-occurrence network of VOSviewer terms - keywords "economy", " shadow", "technology", minimum 4 occurrences for a keyword

Cluster 1	1.corruption 4.information and communication technology 7.tax evasion	2.digitalization 5.parallel economy 8.technological development	3.europe 6. shadow economy
Cluster 2	1.carbon emission 4.innovation	2.climate change 5.productivity	3. energy use
Cluster 3	1.cost benefit analysis 4.shadow price	2.enviromental management 5.sustainable development	3.public policy
Cluster 4	1.article	2.economic development	3.human
Cluster 5	1.china	2.globalization	3.united states

Source: Own processing based on the database on E-nformation and VOSviewer

However, the analysis shows a superficial picture of the scientifically investigated facets of the shadow economy. Because of this, together with the smaller number of scientific papers available for this topic, the minimum number of occurrences for a keyword was reduced to 4. The resulting keywords were processed to avoid their duplication, and thus remained a number of 24 relevant keywords. Through this modification, the analysis can explore more deeply the researched dimensions of the shadow economy.

The Figure 2 provides a detailed and interconnected look at how shadow economy relates to a range of economic, environmental and technical ideas. Central research ideas and current topics are represented by significant nodes such as "shadow economy", "technology development and adoption" and "information and communication technology". This focus indicates a strong interest in examining the effects of digital change on shadow economy, particularly through ICT. Researchers focus on which side the balance is tipped by the technology: its ability to enable unregulated economic activities (such as digital transactions that evade regulatory inspection) and its potential to detect and mitigate these activities. The subject's importance to the future of economic policy and global governance in a highly technological society makes it an obvious a burning matter (Herciu et al., 2023, p. 307).

Avant-garde regional and environmental perspectives are brought into play by 'Europe' being a node adjacent to the "shadow economy". Thus a regional component is added, showing that studies on the shadow economy in European contexts are becoming more popular. This indicates an opportunity for researchers to delve into the specific legislative and regulatory issues facing Europe, particularly given its highly integrated economy. "United States," "China," and "globalization" form a cluster that adds a significant global dimension to the study. This suggests that the underground economy is increasingly being studied in relation to other large economies and the interconnectedness of the world. Thus, people are beginning to realize that the underground economy is affected by international economic dynamics, supply chains and trade and is not limited to a single country.

The grouping of terms indicating an increase in environmental concerns includes "cost-benefit analysis", "environmental management", "sustainable development" and "carbon emissions". This interdisciplinary approach reveals a growing need to understand the indirect effects of shadow economy on the environment, such as the potential for unsustainable practices, resource mismanagement and increased carbon emissions resulting from uncontrolled economic activity. The focus on sustainability suggests a possible avenue for further research. Researchers are beginning to notice the hidden ecological consequences of shadow economy, even if it is still a secondary concern compared to technology.

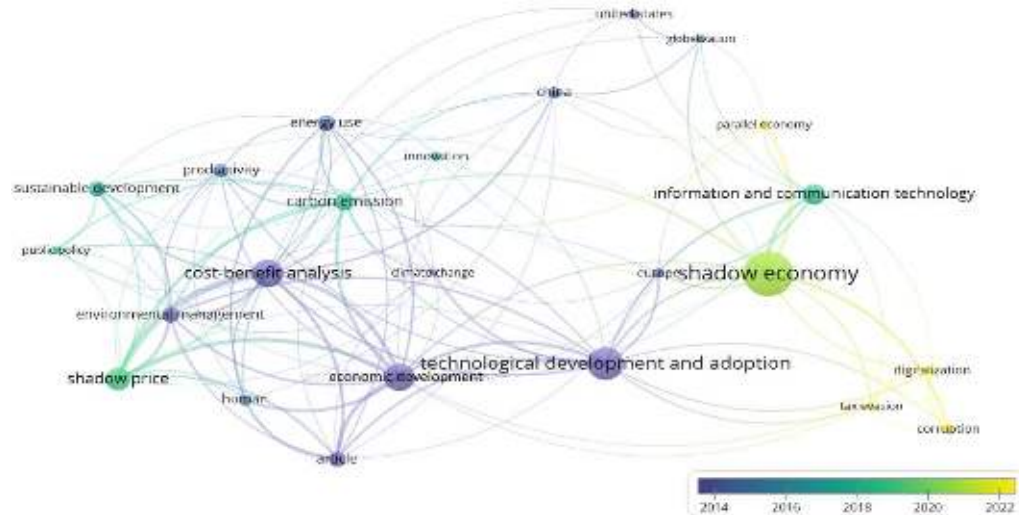
However, some research gaps remain despite the increasingly close links between technology, regional focus and environmental effect. An example is the weak relationship between "public policy" and central nodes, especially the " shadow economy". This discrepancy indicates that while

there has been extensive research on the effects of technology on the shadow economy, there has been less research on the effects of specific policy interventions. Researchers should take advantage of this gap in the literature to examine the effectiveness of regulatory measures, particularly in the European context, and the ways in which governments could use technology to limit informal economic activities.

The link between productivity and shadow economy is another uncharted territory. There appears to be a dearth of research on the effects of informal economic activity on macroeconomic productivity because the network does not include "productivity" as a central node. Particularly as digitization continues to reshape economic structures, future research could investigate this link by examining the possible effects of the shadow economy on productivity.

This view brings together technology, regional politics, and environmental issues, underscoring the multidisciplinary nature of shadow economy studies. To help policymakers strike a balance between economic growth, sustainability and regulatory oversight in a rapidly digitizing world, more research in these areas is needed. This would lead to a better understanding of the role of the underground economy in modern economies.

Figure no. 3 Bibliometric analysis, keywords "economy", "shadow", "technology", minimum 4 occurrences for a keyword, temporal characteristic



Source: Own processing based on the database on E-nformation and VOSviewer

While the "shadow economy", "technology development and adoption" and "information and communication technology" continue to play a significant role, new studies have turned their attention to "digitalisation", "corruption" and "tax evasion". As a result, the topic is becoming increasingly popular and has important consequences for the governance of the digital age, as people ask how digitization impacts informal economic activity and regulatory difficulties.

"United States", "China" and "globalization" in a more subdued tone suggest that research focused on the world or cross-national comparisons has been going on for some time. One possible explanation for the recent growth in research related to "Europe" is the growing interest in studying how the policies of different regions have reacted, especially in the context of European Union regulations. Another explanation may be the much easier access to relevant and long-term statistical data for Europe compared to other areas of the world.

Interest in the environmental costs of the shadow economy has increased, with a new emphasis on sustainability. The clustering around "sustainable development", "environmental management" and "carbon emissions" illustrates this trend. However, there is still a lack of strong links between "public policy" and policy intervention research, even if these topics are relevant. Research on the effects of the underground economy on "productivity" could be fruitful in the future, as this variable appears to have received little attention to date.

There are large knowledge gaps regarding the effectiveness and productivity of public policies, as this historical review shows a trend towards digitization, environmental effects and regional studies. Addressing these gaps could lead to a more complete picture of the function of the underground economy and, in a world where everything is digital, to better targeted and long-term policy responses.

5. Conclusions

The study uses bibliometric analysis, presented through three VOSviewer graphics, to provide a complete picture of the current research landscape on the shadow economy and how it intersects with technology. This discipline of shadow economy studies is dynamic and interdisciplinary. The visualizations show not only the core topics, but also new areas of interest and research needs. The preponderance of technology-related phrases, such as "digitalization," "technology development and adoption," and "information and communication technology," stand out in the three images. The continuing interest in understanding how digital changes are altering informal economic activity is demonstrated by the continued use of these concepts. Digital payment systems, blockchain and information and communication technology (ICT) have all had an effect on unregulated transactions. The change highlights the complex role of technology as a tool for facilitating but also monitoring informal economic activities.

The final image incorporates a chronological overlay, providing a more in-depth look at the data. It shows how "corruption" and "tax evasion" have come under increasing scrutiny in relation to digitalisation. This demonstrates the increased attention paid to the difficulties of digital facilitation of informal economic activities in terms of governance. The field of study involves researchers trying to make sense of the double-edged sword that is technology. On the one hand, it provides new tools for monitoring compliance with regulations, on the other hand, it opens the door to more complex ways of circumventing them. It is to the benefit of decision makers to consider these findings.

Terms such as "carbon emissions", "sustainable development" and "environmental management" highlight another important aspect, namely the effect of the shadow economy on the environment. The increased visibility of expressions over time shows a growing awareness of the environmental implications of informal economic activities. Even if they are still secondary among the technology-focused nodes. A number of environmental problems, including pollution and resource misuse, are exacerbated by the underground economy, as it frequently avoids environmental restrictions. Understanding the effects of economic informality on the environment can help policy makers strike a better balance between economic and environmental objectives, so this is an issue that needs more investigation.

The use of time also reveals regional differences in shadow economy studies. The recent addition of "Europe" indicates a growing curiosity about how other areas, particularly the European Union, are dealing with regulatory hurdles related to the underground economy. Nodes for "United States," "China," and "globalization" show that comparing other countries is still important, but that people are starting to focus more on the effectiveness of regional policies. As a result of this development, a more in-depth analysis of European policy frameworks is possible, which is likely a reflection of the region's distinct regulatory climate and data availability. In order to better understand best practices and policy effectiveness, comparative studies on how different areas and countries deal with shadow economy issues could be very useful.

Even with all these improvements, there are still some gaps. The term "public policy" is still only loosely related to general themes, indicating a neglected part of the shadow economy literature. More research is needed on the effectiveness, cost-effectiveness and technological adaptability of certain policy initiatives. Furthermore, the low emphasis on "productivity" implies that the monetary effects of the shadow economy, particularly on efficiency and productivity, have not been studied in detail. To better understand the effect of the underground economy on long-term GDP growth, it might be useful to analyze the relationship between informal activities and macroeconomic productivity.

These images show how shadow economy is complex and interconnected with many other factors, including politics, the environment, technology and productivity. A comprehensive research strategy that considers these relationships holistically is needed, as the illustrated development shows. In an increasingly digitized and interconnected world, it will be imperative to close the gaps

in our understanding of the underground economy. This includes policy impact assessments, productivity impacts and environmental effects. To strike a balance between economic innovation, regulatory oversight and sustainable development, policymakers will benefit from this deeper understanding when designing tailored actions.

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An Overview of Wages in European Union

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Abstract

Labor, the most important factor of production, expects fair compensation in exchange for their work or services. In other words, all people employed within an organization work mainly for a monetary reward. Wage is an essential element for employees, as the value of the wage highlights the value of the work performed. Special attention is paid to the minimum wage, one of the wage categories, as it leads to improving the lives of the most vulnerable categories on the labor market. Therefore, this paper aims to present the minimum wages change in Romania, that wage which ensures a decent standard of living, over a period of 20 years. The second part of the study presents the situation of Romania in comparison with other European Union member states, from the perspective of the same indicator.

Key words: remuneration, pay, labour market, wage

J.E.L. classification: E24, J31

1. Introduction

Wages have an enormous impact on the economy, many aspects that fall within the research area of macroeconomics being related to wages: employment levels, price stability, consumption, production, income distribution. Wages are an essential factor in the social and economic life of any community. Wages are one of the most significant elements of job satisfaction, a major subject of collective bargaining and a subject of law in many countries. From an economic point of view, wages are seen as the payment of compensation in exchange for work performed. It is the most important for an employee, as his standard of living and that of his family depend on his earnings.

2. Theoretical background

The main source of income that an individual relies on when purchasing the goods or services necessary for themselves and their family is represented by the salary. The security of receiving a salary at a level that reflects the value of the work performed is given by the conclusion of an employment contract (Florișteanu, 2024, p. 30). Thus, the Romanian Labor Code explains that the salary represents the consideration for the work performed by the employee based on the individual employment contract. (Law no. 53/2003, 2003).

The wage can be viewed from the perspective of employers and employees within enterprises. Employers see wages as a cost to the enterprise. Although they have been tempted to save on this cost, employers have understood that it is not possible to attract and maintain a qualified, efficient workforce without adequate compensation. On the other hand, for employees (those people who use their knowledge, skills and together with other factors of production, produce goods or services) salaries are an income and the means to satisfy their needs that ensure a certain standard of living. They expect remuneration at least the same as that obtained by other people equipped with similar skills and performing similar work. (Investopedia, 2020).

In specialized literature, wage is defined as a monetary remuneration received by an employee for his contribution for achieving organizational objectives, as payments received regularly, monthly, weekly or hourly or even annually, quarterly as a result of their work. (Clark et al, 2009, p. 435). In the perception of Sorn et al (2003, p.3) the salary that an employee earns within an organization is an important factor in the success of achieving the company's objectives. The salary obtained by an employee consists of the basic salary, incentives, vouchers, facilities, insurance.

Suwatno et al (2007, p. 125) wrote that wage appears as a substitute for the services that were provided by workers in their workfield. Then Mulyadi (2013, p. 179) stated that wage is seen as a payment for the provision of services performed by employees.

In a study conducted by Obikeze et al (2003, p. 286) they explained that salaries are the reward that individuals receive from the organization in exchange for their work and that each organization has its own distinct salary system.

The minimum wage is a basic element of public policy, being a tool to combat poverty and reduce inequality, including that between men and women (Cámara et al, 2024, p. 198). It is explained as the minimum remuneration that an employer must pay to employees in exchange for work performed over a period of time, with the mention that it cannot be reduced by collective or individual employment contract.

The minimum wage aims to protect employees from unjustified wages and to ensure a minimum standard of living for all those in employment field. Determining the appropriate level of the minimum wage is a complex process, in which several factors must be taken into account, such as: the needs of workers and their families, the cost of living and its changes, relative living standards, the general level of wages in the country, labor productivity and the economic development of the country (the last two factors mentioned are economic factors). (International Labor Organization, 2017).

3. Research methodology

The purpose of this paper is to analyze the evolution of minimum wages in Romania during the period 2005-2024, as well as the value of this indicator among the member states of the European Union, taking into account the different level of development of the member states.

For this reason, we propose a quantitative approach, which involved the collection and analysis of statistical data, but also their interpretation by comparing wages at the national level and by comparing with the member states of the European Union.

4. Findings

4.1. Analysis of the minimum wage in Romania

In Romania, the gross minimum wage is the lowest monthly or hourly remuneration that employers are required by law to pay to the employees in the country. The amount is established by Government decision, after consulting unions and employers' associations, for a normal work schedule of 8 hours per day. It is reviewed and adjusted periodically, depending on economic indicators such as inflation. (Law no. 53/2003, 2003).

Table no. 1 Evolution of the gross minimum wage, per month, in Romania 2005-2024

Year/month	Gross minimum wage, per month	Increase (%)	RON/hour	Gross value in euros
2005	310 RON	-	-	85€
2006	330 RON	6,5%	1,95	90€
2007	390 RON	18,2%	2,29	114€
2008 January October	500 RON	28,2%	2,94	140€
	540 RON	8,0%	3,17	142€
2009	600 RON	11,1%	3,52	142€
2010	600 RON	-	3,52	142€

2011	670 RON	11,7%	3,94	159€
2012	700 RON	4,5%	4,13	155€
2013 February	750 RON	7,1%	4,44	171€
July	800 RON	6,7%	4,47	179€
2014 January	850 RON	6,3%	5,06	189€
July	900 RON	5,9%	5,38	205€
2015 January	975 RON	8,3%	5,78	216€
July	1050 RON	7,7%	6,22	236€
2016 June	1250 RON	19,0%	7,38	275€
2017	1450 RON	16,0%	8,73	320,51€
2018	1900 RON	37,9%	11,40	413,25€
2019	2080 RON	7,89%	14,04	444,84€
2020	2230 RON	7,21%	13,32	466,63€
2021 June	2300 RON	3,0%	13,87	472,36€
2022	2550 RON	10,9%	15,23	515€
2023	3000 RON	17,6%	18,14	607€
2024 January	3300 RON	10,0%	19,96	663€
June	3700 RON	12,1%	22,02	743€

Source: www.insse.ro [Accessed on 10.09.2024]

The gross minimum wage in the economy has increased steadily, the increases highlighting both inflation and the authorities' efforts to support the purchasing power of employees. The year 2016 is distinguished by a substantial increase in wages as a result of legislative changes and the year 2019 by the change in the method of payment of contributions, more precisely the transfer of contributions from the employer to the employee. Also in 2019, those with higher education and those employed in the construction sector are paid differently. Thus, the gross minimum wage of employees with higher education was 2.350 Ron and for those who work in construction the gross minimum wage was 3.000 Ron.

The year 2023 brought changes to the salary system. According to Government Decision No. 1.447/2022, the guaranteed minimum gross basic salary per country became 3.000 Ron per month, representing 18.14 Ron/hour, for an average work schedule of 165.33 hours per month.

The year 2024 marks two increases in the minimum wage: in January it increased to 3300 Ron and in June it was increased with 400 Ron, reaching the value of 3700 Ron, from it benefiting approximately 1.8 million employees. This means that it is with 12.12% higher compared to the previous year, the increase being higher than the consumer price index in 2024 (6.6%). In other words, workers have gained purchasing power in the last year. The value of the gross minimum wage is 743.5 euros per month, or 8,922 euros per year.

The nominal increase in 2024 of 700 ron (300 in January and 400 in July) is almost as big as the increase recorded over 10 years, between 2006 and 2016. In 2006, the gross minimum wage was 330 Ron per month, and in July 2015 the gross minimum wage had reached 1050 Ron (the increase being 720 Ron over the entire period).

For 2025, is expected an increase in the gross minimum wage of 9.5%, reaching 4050 Ron/month (814 euros), which means 24.5 Ron per hour, in an attempt to reduce Romania's gaps compared to other European countries.

4.2. Wage analysis within the European Union countries

Income inequality, job insecurity, ensuring sufficient income to allow employees to pay their living expenses are some of the aspects that have been the basis for the implementation of the policy of establishing a minimum wage among European Union countries. (European Commission, 2020, p.3).

In general, the establishment of minimum wage levels returns to the national governments of each country. However, the mechanisms for establishing these minimum wages differ from country to country, depending on the adjustment process (indexation), exemptions for different groups of population (young people, trainees) and whether different social partners are consulted. As a result, the level and evolution of minimum wages differ within the member countries of the European

Union.

In the European Union, 22 countries currently have a minimum gross wage set by law. Finland, Sweden, Austria, Denmark and Italy are exceptions, as these countries do not have a minimum wage set by law, but a minimum wage set by collective agreements. For example, in Sweden, wage rates are set through collective bargaining between employers and unions, which is considered a reliable method of ensuring fair remuneration for workers in different sectors. (Eurofound, 2024, p 12).

Analyzing the data in the table below, it can be seen that the monthly minimum wage varies greatly between the member states of the European Union, from 477 euros recorded in Bulgaria to 2 571 euros reached in Luxembourg. The group of 6 countries formed by Luxembourg, Ireland, Netherlands, Belgium, Germany and France continues to report the highest gross minimum wages in the EU, the level being over 1500 euros. Employees earn a gross minimum wage ranging between 1000 and 1500 euros in Cyprus, Spain, Slovenia. Poland, Greece, Portugal, Malta, Lithuania, Croatia, Estonia, Czech Republic, Slovakia, Romania, Latvia, Hungary and Bulgaria are the countries where the minimum wage per economy varies between 477 and 1000 euros per month.

Table no. 2 Evolution of the gross minimum wage in the European Union, January 2024

Country	Minimum gross wage monthly, in euros	Monthly minimum wage in purchasing power standards (PPS)
Luxembourg	2.571	1877
Ireland	2146	1508
Netherlands	2070	1778
Germany	2054	1883
Belgium	1994	1729
France	1767	1599
Spain	1323	1374
Slovenia	1254	1408
Cyprus	1000	1087
Poland	978	1491
Portugal	957	1086
Malta	925	1029
Lithuania	924	1172
Greece	910	1031
Croatia	840	1143
Estonia	820	840
Czech Republic	764	948
Slovakia	750	869
Latvia	700	823
Hungary	697	1007
Romania	664	1129
Bulgaria	477	816

Source: www.eurostat.eu [Accessed on 10.09.2024]

As it can be seen, *Luxembourg* is the country with the highest wage level in the European Union, being famous for its solid economy and high standard of living. Here, wage adjustment is done automatically, the process is called wage indexation, to match inflation. It occurs when the cost of living becomes expensive enough, thus requiring higher wages. Usually, indexation takes place twice per month, but last year, in 2023, due to very high inflation, minimum wages were adjusted three times. In 2024, the value of the minimum wage in Luxembourg was influenced by the experience and age of the employee. Unskilled adult workers were remunerated with at least 2.571 euros per month, while skilled employees received 3,086 euros. In the case of teenage employees, the minimum payment is somewhere around 75-80% of the salary of an unskilled worker. In the case of the average gross salary, employed people are paid 5.144 euros per month, 3.540 euros net, almost twice as much as the average wage in European Union, 1.531 euros per month.

In the case of *Germany*, the minimum wage guaranteed by law was established starting from January 1st 2015, the country being of those with a minimum wage level of over 1500 euros. The purpose of introducing the minimum wage in the economy was to unify the wage system, which was previously established according to the industry. It is adjusted regularly (without mentioning a specific period when it should be reassessed), taking into account factors such as the local cost of living, the state of the economy. The last adjustment was made on January 1st 2024, after it had previously been increased in October 2022.

Romania is the country that has experienced consecutive annual increases in the minimum wage in the last ten years. Thus, in the period 2014-2024 the average annual growth rate of the gross minimum wage in Romania was 13.3%, followed by Lithuania with an increase of 12.3% and Bulgaria with a rate of 10.6%. The lowest growth rates of the gross minimum wage were identified in Luxembourg (3%), Greece (2.9%) and France (2%). However, the wage level in Romania is below that recorded in other countries in Central and Eastern Europe, ranking in the penultimate place with a value of 664 euros per month. Only Bulgaria has an income lower than Romania, with a wage of 477 euros per month. Most employees who receive the gross minimum wage in Romania come from the construction, agriculture and food industry sectors.

Immediately ahead of Romania with a guaranteed gross minimum wage of 697 euros per month in 2024 is *Hungary*. It should be noted that in Hungary there are two types of minimum wage, depending on the education required to fill in a position. The guaranteed minimum wage requires education, while the minimum wage does not require a higher qualification.

However, the gaps between countries are significantly smaller if price level differences are eliminated. This indicator is called the purchasing power standard (PPS) and allows a more objective comparison of the purchasing power of the minimum wage between countries. Thus, minimum wages in member states with lower price levels expressed in purchasing power standards become relatively higher compared to those countries with higher price levels. For example, in 2024 Luxembourg had the highest minimum wage in euros and was 5.4 times higher than that in Bulgaria, which was the lowest wage in the EU. Expressed in PPS, the gap narrows, the highest (in Luxembourg) being 2.4 times than the lowest one. The highest value of the monthly minimum wage in purchasing power standards was recorded in Germany, but values above 1.200 euros were also recorded in the Netherlands, Luxembourg, France, Spain, Belgium, Ireland, Slovenia and Poland.

5. Conclusions

Nowadays, the wages offered by enterprises tend to determine the standard of living and social position in the community. Over time, one of the main functions of the minimum wage has been to protect against poverty, but other functions can be listed such as: the minimum wage contributes to setting fair wages, supporting disadvantaged groups, maintaining the purchasing power of employees, avoiding conflicts in the workplace, supporting labor productivity, reducing social inequalities and a tool to combat high unemployment.

In this context, national governments and European Union institutions have stressed the importance of paying an adequate minimum wage in the economy so that all people in employment have decent living conditions. Of the 27 member states, 22 have a minimum wage set by law (many of them with a long historical tradition of minimum wages) and the other 5 have a minimum wage level set through collective bargaining.

Although the minimum wage in Romania has increased in the last ten years, its value remains one of the lowest in the European Union. These increases should be accompanied by appropriate economic policies and the foundation of the minimum wage policy should be represented by the minimum consumer basket for a decent standard of living.

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The Institutionalization of Ethics and the Role of Human Resources in Ethical Behavior in the Public Sector

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Abstract

In order to identify the ethical peculiarities of human resources management in the public administration, we studied the specialized literature, as well as documents published by international and European bodies. The research method used is qualitative, the techniques used are information gathering, analysis, interpretation, synthesis, induction and deduction. The research aimed to explore ethical practices in business, how human resources can contribute to increasing ethics as a whole at the level of a company or a public institution.

With the help of the questionnaire, I was able to analyze structured data resulting from the information obtained from the people employed in the central public administration.

The result of the study is the following: at the level of the central public organization, the institutionalization of ethics is in an open transition process aimed at both the individual and the organizational level.

Key words: management, code of ethics, institutionalization of ethics, ethical evaluation questionnaire

J.E.L. classification: M50, L32

1. Introduction

Every system, at all levels, depends heavily on human resources to implement strategies. Maintaining and improving standards is only possible through the ethical behavior of the people involved. The lack or poor management of human resources within the public system reduces the performance of the public system, regardless of how much is invested in other resources. The major premise of human resource management in the public sector is determined by the effectiveness and morality of managers.

Data on ethics institutionalization activities in the central public system are limited. As a rule, indicators regarding the ethical performance of human resources in public administration focus on the results of questionnaires and the code of ethics.

No single indicator can capture the complexity of implementing ethics at all organizational levels. The challenge that this research report aims to answer will consist in researching the particularities recorded in the management of human resources in the public system.

2. Theoretical background

The ability to recognize and deal with complex business ethics issues has become a significant priority in 21st century organizations. Financial crises always have an impact on consumer trust in organizations that provide financial services. The object of study of business ethics is aimed at obtaining answers to the question of whether the practices of the organization (in relation to all interested parties in its activities) are acceptable. Business ethics exceeds the legality of actions,

taking into account not only compliance with all normative acts that regulate the organization's activity, but also with some principles, values, rules acceptable from an ethical or moral point of view by society. By its very nature, the subject of business ethics is controversial and there is no universally accepted approach to solving its problems.

Starting with the second half of the 20th century, the specialized literature undertook an examination of the role of business in society (Carroll, 1999). At the heart of this trend has been a particular emphasis on the ethical dimensions of business (Crane and Matten, 2010) and the responsibilities of an organization towards its stakeholders, not only towards shareholders (Freeman et al., 2010). Researchers studying these approaches have done so both conceptually and empirically, but the concepts and approaches related to business ethics and corporate social responsibility are still changing and highly contested in the literature (Crane et al., 2008).

At the same time, managers developed practices, including those related to business ethics, social responsibility, and corporate governance within their organizations. There are many reasons organizations care about applying these practices: reducing costs, mitigating risks, gaining legitimacy, gaining competitive advantage and creating new value (Weller, 2016). In addition, Trevino and Weaver (2003) stated institutional pressures, including industry standards, regulations and norms are the primary motivation for the organization to implement strategies in these areas, but managers are the decision makers regarding the practices that are created and implemented. In large multinational companies, practices have been embedded in different parts of the organization, with ethics being especially connected to the legal function, and social responsibility practices being especially connected to the marketing department, human resources department, or operational departments. Scholars and managers have recommended aligning these practices within companies (Petry, 2008), but there is little empirical research exploring the impact of alignment or the reasons why it has not become a common practice within organizations.

The evolution of a business organization is based on a strong ethical code and code of conduct that are developed to guide both management and employees in day-to-day activities and strategic decisions (Stevens et al., 2005). Business ethics supports the development of ethical human resource practices, which will lead to the establishment of a system of shared values that channel, shape and direct ethical behavior in the workplace.

3. Research methodology

As part of the research, we explored ethical practices in business, how human resources can contribute to increasing ethics as a whole at the level of a company or public institution, approached on four main research axes:

- theoretical level research of the relationship between business ethics and human resources, and their role in the implementation of business ethics;
- establishing a methodological framework for researching the relationship between business ethics and human resources, and their role in the implementation of business ethics;
- the evaluation of the dimensions of business ethics within organizations in Romania;
- the empirical investigation of the direct relationship between business ethics and human resources and of the moderating variables involved in indirect relationships.

In large multinational companies, the practices have been embedded in different parts of the organization, with ethics being particularly linked to the legal function and social responsibility practices being particularly connected to the marketing department, human resources department or operational departments. Researchers and managers have recommended the alignment of these practices within public companies as well (Petry, 2008), but there is little empirical research that explores the impact of alignment or the reasons why it has not become a common practice within the public sector.

The evolution of a business organization relies on a strong ethical code and code of conduct that are developed to guide both management and employees in day-to-day activities and strategic decisions (Stevens et al., 2005). Business ethics supports the development of ethical human resource

practices that will lead to the establishment of a shared value system that channels, shapes and directs ethical behavior in the workplace.

The indicators of the ethical performance of human resources in public administration focus on the results of questionnaires and the code of ethics.

No single indicator can capture the complexity of implementing ethics at all organizational levels. The challenge that this research report aims to answer will consist in researching the particularities recorded in the management of human resources in the public system.

Three levels of ethical standards can be identified: normative acts, organizational policies and procedures and employee moral standards. Normative acts define for society those actions that are allowed and those that are not. The law only sets the minimum standard of behavior. At the same time, actions that are legal may not be ethical. Therefore, simply obeying the law is insufficient as a guide to ethical behavior. Organizational policies and procedures serve as guides for employees in making day-to-day decisions. Employee moral standards are defined by the position employees take when faced with a situation that is not regulated by law or organizational policies and procedures. A company's culture can support or undermine its employees' concept of what constitutes ethical behavior (Peter, 2021).

4. Findings

For many readers the article will form the basis for evaluating the ethical knowledge of respondents in the organization. The wording of the questions must be clear, concrete, follow the grammatical rules and be as short as possible, also using an open question.

Even if the majority of respondents consider such research useless, the human resources department reinforces the idea that compliance with moral rules improves the organization's image.

Due to the absence of data, a situation of ethical management cannot be outlined in most organizations in Romania. In order not to make unfounded assumptions, I will instrument the present research that integrates ethical concerns. Based on the proposed questionnaire, I will test the state of affairs of ethical management within the group. The number of responses will be significant to draw relevant conclusions about the ethical organizational culture.

The existence of an ethics department within the group confirms the fact that there is an ethical, reactive organizational culture, consistent with openness to moral issues. A professional approach, by the group's specialists, indicates the stage of evolution of ethics in the organization.

As mentioned by Mitchell, 2021, I believe that the advantages of ethical behavior in business include the following aspects:

1) achieving customer loyalty, a pool of loyal customers being one of the keys to business success. If customers believe they have been treated unfairly, they will abandon the organization's products or services. Also, a company's reputation for ethical behavior can help it create a good image in the market, which can bring in new customers.

Conversely, a bad reputation for unethical dealings affects the organization's chances of getting new customers. Dissatisfied customers can spread the word about their negative experiences with the organization's products or services.

2) retention of talented employees, because talented employees demand to be fairly rewarded for their efforts and performance. Organizations that are fair and honest in their employee relations will attract and retain the most talented individuals in the market.

3) ensuring a positive work environment, given that ethical employees are perceived as employees who work in and for the team, rather than as competitive individuals. They develop fair and honest relationships with colleagues, and supervisors trust them encouraging involvement and empowerment.

4) avoiding issues bordering on legality in order to maximize profit, such as completely disregarding environmental regulations or labor laws, ignoring worker safety hazards, or using poor quality materials in making their products. In addition to penalties that can be severe, the resulting negative publicity can cause long-term damage to a company's reputation that can be even more costly than attorneys' fees or fines paid.

Although the respondents declaratively recognize the importance of ethical issues in their companies, they still reject the professionalization of ethics management ("we can do it too") and reject (sometimes very firmly) the introduction of any ethical management tools.

As far as morality is concerned, 99% of the people interviewed consider that the issue of immorality is very important, because it is appreciated that compliance with ethical rules increases trust in the public administration (Figure 1).

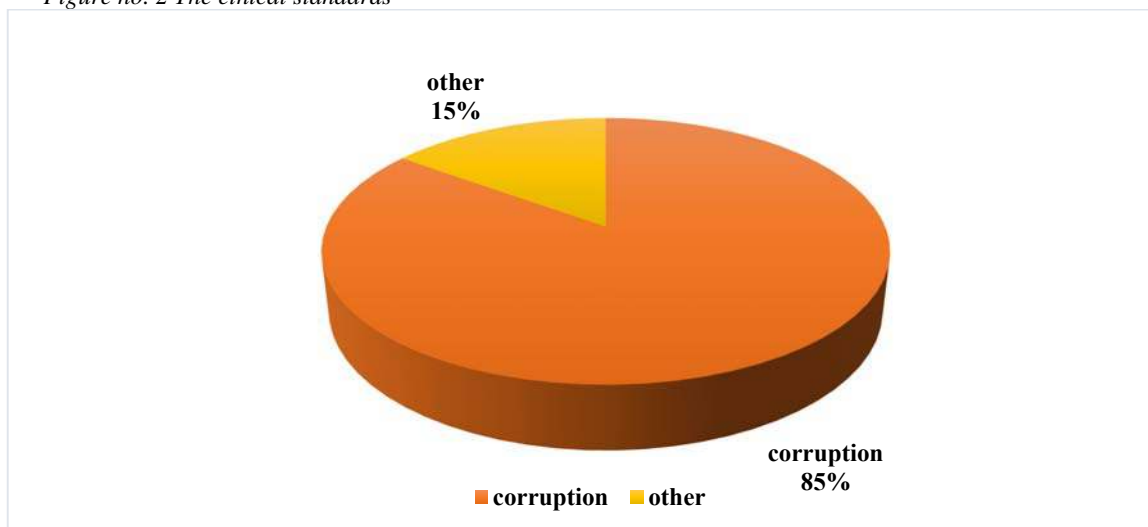
Figure no. 1 The importance of morality



Source: Questionnaires

Regarding the current state of ethical standards that ensure transparency and challenges related to corruption, 85% of the people interviewed considered corruption the main problem of public administration (Figure 2).

Figure no. 2 The ethical standards



Source: Questionnaires

Corruption prevention strategies:

1. Government transparency and accountability:
 - Free access to public information.
 - Public budgets open and audited by independent institutions.

2. Legislative measures:

- The adoption of strict anti-corruption laws and their enforcement.
- Creation and support of independent institutions for investigation and prevention of corruption (eg: DNA, ANI);

3. Institutional reform:

- Digitization and automation of public services to reduce human interaction (reducing opportunities for corruption).
- Reducing bureaucracy and simplifying administrative procedures.

4. Education and awareness:

- Civic education and anti-corruption campaigns.
- Introducing ethics and morality courses in schools and universities.

5. International partnerships:

- Collaboration with international organizations, such as Transparency International and the UN, to implement global anti-corruption standards.
- International conventions such as the United Nations Convention against Corruption (UNCAC).

For a better implementation of ethics in Romania, I propose a greater involvement of civil society, non-governmental organizations and the media in promoting a culture of integrity and transparency.

5. Conclusions

Institutionalizing ethics is a big challenge for developing countries. In this sense, we carried out exploratory research of the specialized literature, as well as of the documents issued by international and European bodies whose object is the institutionalization of ethics and the role of human resources in the public sector.

The originality of the research consists in approaching ethics in the organization from the perspective of human resources, the main stakeholder that contributes to the implementation of ethical behavior. In order to outline an ethical and moral profile of the manager in Romania, I discovered that ethics should be part of everyone's education, so that it then becomes a primary instinct. Business ethics supports the development of ethical HR practices, which will lead to the establishment of a system of shared values that shape and guide ethical behavior in the workplace. The institutionalization of ethics in business is a necessity that is at the beginning of the road in our country, but a sustainable economic evolution requires the integration of ethics at all levels of a structure.

The challenge that the research paper aims to answer consists in evaluating the level of knowledge of the staff in the public system regarding the activity of ethical counseling, avoiding situations of incompatibility/conflict of interests, evaluating integrity incidents.

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Factor Analysis of the Distribution of Religious Denominations in Romania: Considerations for Business Administration

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Abstract

The study analyzes the distribution of religious denominations in the Romanian counties using correspondence factor analysis, exploring its implications for business management. Based on official statistical data, the research highlights the relationships between confessional structure and regional specificity, identifying the main dimensions that explain religious variation. The results show that the confessional diversity in Transylvania contrasts with the predominantly orthodox uniformity in the south and east of the country, and that religious particularities directly influence cultural values, business strategies and managerial decisions. The integration of literature emphasizes the role of religion as a shaping force in strategic planning, sustainable development and business ethics. The study contributes to an interdisciplinary understanding of the dynamics between religion and economics, providing an analytical framework for adapting organizational strategies to cultural and confessional characteristics. Findings reveal the importance of a customized approach to conducting business across regional religious distribution, promoting social inclusion and cohesion.

Key words: religion, education, managerial decisions, correspondence factor analysis

J.E.L. classification: M14, Z12, Z13

1. Introduction

Religious denominations are a fundamental component of the socio-cultural structure of a society, influencing not only the identity of communities but also individual and collective behavior. In Romania, religion has played an essential role throughout history, shaping values, norms and practices that are reflected in various fields, including business management. In a global context marked by economic dynamism and multiculturalism, understanding the impact of religious distribution on managerial decisions and organizational culture becomes a relevant concern for both theorists and practitioners.

The study of the distribution of religious denominations in Romania using factorial methods brings an interesting perspective on how religious aspects may influence different dimensions of management. The use of factorial correspondence analysis provides a robust statistical tool for identifying complex patterns and relationships between confessional structures and the geographical, demographic and socio-economic characteristics of counties. This approach helps to reveal correlations that are relevant for strategic business decisions, including marketing, recruitment and integration of employees, or the creation of locally tailored organizational policies. The values and rules promoted by different religious denominations may directly or indirectly influence organizational culture, business ethics and consumer preferences. In this sense, the analysis of confessional distribution is not limited to a simple statistical exploration but provides a basis for a better understanding of local dynamics and for adapting business strategies to cultural specificity.

The present study aims to address this issue through a rigorous methodology, combining factor analysis of correspondences with a theoretical interpretation of the results obtained. The main objective is to identify relevant patterns that can support both managerial decisions and the development of sustainable organizational practices. In addition, the research makes a significant contribution to the literature by providing an integrative perspective on the link between religion,

regional development and business management in Romania. Through its interdisciplinary approach, this study opens new research directions, revealing the potential that the analysis of confessional distribution has in supporting inclusive, ethical and culturally adapted business models. The results can also serve as a starting point for the formulation of public policies that promote social cohesion and support economic development on a sustainable and inclusive basis.

2. Literature review

Religion and its influences on economic and managerial behavior is a central topic in recent academic literature, highlighting its role as a shaping force at the social and organizational level. The study of the interaction between religion and economic practices has demonstrated that religious values and beliefs influence entrepreneurial behaviors, managerial ethics and business strategies. Block, Fisch, and Rehan (2020) presented a comprehensive mapping of the field, highlighting the importance of religion as a determinant of entrepreneurial activities, while Dana (2021) reinforced this perspective, arguing that religion provides an explanatory framework for the diversity of entrepreneurial initiatives.

In the small business context, Deller et al. (2018) demonstrated how social capital derived from religious communities facilitates entrepreneurship by creating networks based on trust and community support. Complementarily, Kumar et al. (2022) portrayed religion as a social shaping force influencing organizational dynamics and business strategies. These findings are supported by the study of Gallego-Alvarez et al. (2020), who show how religious norms influence ethical decisions within organizations, and Farooq, Hao, and Liu (2019), who examine the link between religiosity and corporate social responsibility. In the area of public administration and the management of religious diversity, Ongaro and Tantardini (2024) provide an extensive review of the literature on religion, spirituality and public administration, highlighting their implications for public policy. Similarly, Hennekam et al. (2018) address the challenges of managing religious diversity in secular organizations, highlighting the need for inclusive practices to promote organizational harmony.

Another key area is the relationship between religion and sustainability. Herciu et al. (2023) proposed circular economy-oriented business models, emphasizing the role of ethical values in developing sustainable practices. Similarly, Rus (2023) and Paraschiv and Stan (2023) explored the impact of sustainability on regional development and collective environmental protection initiatives, identifying the potential of religion to support responsible and sustainable actions in communities. Rus's (2018) analysis of research funding raises the role of public and private funds in supporting regional projects. In counties with high confessional diversity, accessing funds for community initiatives may be influenced by confessional structure and priorities. The educational and technological dimension has been addressed by Aivaz (2021), which examined the impact of ICT on living standards and education, highlighting the importance of digitization in reducing regional disparities. This links with the perspective of Aivaz and Petre (2024), who systematically investigated the influence of religion on business management, arguing that technology can facilitate better integration of religious diversity into managerial strategies.

Issues related to regional development and public governance are analyzed by Stan and Cortel (2022), who emphasize the importance of citizens' perceptions of sustainable local planning. In counties with a high share of religious communities, these initiatives need to be aligned with local confessional values and standards. This aspect is complemented by Florea, Mirea and Susu (2020), who explore the link between cultural heritage and social indicators, demonstrating how religion can contribute to promoting social cohesion and regional identity. Van Buren III et al. (2020) approaches religion as a macro-social force influencing the business environment, asking fundamental questions about the interaction between religion and the economy. These insights contribute to a deeper understanding of how religion shapes business practices at both micro and macro levels. In terms of fundamental rights, Braşoveanu (2015) emphasizes the importance of human rights protection in the European context, pointing to the role of religion in sustaining dignity and equality. Also, regional development and environmental impact, discussed by Braşoveanu (2023), reveal how religious and community initiatives can support economic and social sustainability.

These theoretical backgrounds support the integration of religion as an explanatory variable in the analysis of the confessional distribution in Romania, providing an interdisciplinary framework for understanding how religious structure shapes business strategies, regional policies and sustainable initiatives. This study extends these insights, providing a statistical and contextual approach to explore the impact of religion on managerial decisions and organizational culture.

3. Research methodology

The present research aims to analyze the confessional distribution in Romanian counties using advanced statistical methods to identify the relationships between religious structure and its implications for business management. The methodology used combines quantitative approaches, such as factorial correspondence analysis, with contextual interpretation to provide a deep and integrated understanding of the data. The data used in this research were collected from the National Institute of Statistics of Romania and were processed to create a correspondence matrix between the variables representing the religious denominations and the counties analyzed. The matrix thus obtained was used as a starting point for the factorial correspondence analysis, a multivariate statistical method, ideal for highlighting relationships between categorical variables. In interpreting the results, a narrative approach, combining statistical observations with the literature, was used to explain how confessional distribution influences business strategies and organizational cultures. This interdisciplinary approach integrates religious, social and economic perspectives, providing a holistic view of the impact of religion on managerial decisions.

4. Findings

The distribution of religious denominations by Romanian counties, presented in Table 1, gives a detailed insight into the religious diversity and cultural specificity of each region. The Orthodox religion dominates the national confessional landscape, being in the majority in almost all counties. This Orthodox hegemony emphasizes the historical and cultural importance of this denomination in defining national identity. In counties such as Bucharest, Iași and Cluj, counties with many inhabitants, the number of people declared to be Orthodox is overwhelming, in some cases exceeding half a million.

Confessional diversity is more pronounced in the Transylvanian regions, where denominations such as Roman Catholics, Greek Catholics and Reformed hold a significant share. These denominations reflect both the multicultural history of the region and the religious influences specific to the Central European context. Cluj is characterized by a relative balance between Orthodox and other denominations, such as Roman Catholics and Greek Catholics, which contributes to a particular religious and cultural dynamic. In counties such as Harghita and Covasna, Roman Catholics even make up most of the population, underlining the historical presence of Hungarian communities. In the southern and eastern regions, characterized by an overwhelming Orthodox majority, religious diversity is less, but not insignificant. In the counties of Constanța and Tulcea, there are Muslim communities, reflecting the historical links of these regions with the Ottoman Empire and the Turkish and Tatar populations.

On the other hand, categories that include people with no religion, atheists or agnostics are more frequent in large urban centers such as Bucharest. This indicates a trend towards secularization, influenced by modernization and urbanization. Also, the category *information not available* is surprisingly consistent, especially in large cities, suggesting a reticence of the population to declare their religious affiliation.

This confessional diversity has significant implications for business management. In counties where multiple denominations coexist, organizational culture and managerial decisions need to be more sensitive to cultural differences. Regions with high religious diversity, such as Transylvania, require more inclusive and locally adapted strategies. Also, in predominantly Orthodox regions, traditional values and norms play a central role in shaping individual and collective behavior. These religious dynamic influences not only organizational culture but also marketing strategies. Companies that want to develop their business in Romania need to take local specificities into account, customizing their messages and products according to the religious values and traditions of

the communities. In areas with high confessional diversity, such adaptation can be a significant competitive advantage.

Thus, analyzing confessional distribution becomes more than just a statistical exercise. It provides a deep understanding of the cultural and social context, essential for the development of ethical and inclusive organizational policies that support social cohesion and foster sustainable economic development. This research emphasizes the importance of religion as a shaping factor not only in social life but also in business dynamics.

Table no. 1 Distribution of religious denominations by Romanian counties

County	Advent	Agnostic	No Religion	Atheist	Baptist	No Religion	Greek Cath	No Availab	Muslim	Orthodox	Pentecostal	Reformed	Roman Cath	Active Margin
AB	462	184	464	439	3133	922	7649	34753	93	253901	7238	9306	2849	321393
AG	829	287	369	809	322	789	103	59724	191	496924	3129	59	718	564253
AR	4130	319	1479	954	12499	1869	3039	44519	344	267186	33585	7531	27565	405019
B	3133	9956	2027	19517	2883	17491	2427	471464	8015	1150455	3587	919	17669	1709543
BC	1570	222	219	540	581	588	673	82559	143	414398	8150	85	89742	599470
BH	1910	511	1390	1241	21336	2770	9890	53194	308	295340	40643	79723	39893	548149
BN	1308	131	299	314	1832	675	4264	26888	61	221867	24334	9430	2374	293777
BR	568	114	87	372	373	311	57	34452	302	241656	880	27	643	279842
BT	1671	97	143	306	769	367	38	37365	47	337508	11164	23	547	390045
BV	1718	1021	1021	2436	1649	3349	1980	82030	289	395139	12864	8494	15105	527095
BZ	1616	138	96	379	179	418	31	42576	79	355999	2356	18	397	404282
CJ	2795	2888	1790	5401	7653	7612	17886	101877	686	420734	21503	57248	18467	666540
CL	697	73	134	262	173	240	35	30349	436	248139	2065	11	226	282840
CS	371	83	276	314	7945	574	1002	33419	36	177127	8362	569	12614	242692
CT	1066	650	265	1963	1038	1703	194	112683	36725	488180	2703	114	4000	651284
CV	777	48	293	192	409	978	435	15349	23	39857	7231	60625	64008	190225
DB	2577	212	291	568	298	490	75	43145	166	421289	5983	41	709	475844
DJ	1438	412	255	1085	824	963	95	78182	435	509515	3241	88	831	597364
GJ	409	87	44	246	554	206	60	29171	37	280475	2312	42	400	314043
GL	1584	365	196	971	310	815	62	71450	210	410903	7695	67	1149	495777
GR	932	92	232	266	329	241	32	27490	201	230224	620	22	362	261043
HD	816	231	612	765	4033	1377	2043	48022	120	270061	14173	5046	11147	358446
HR	597	71	469	217	993	1899	771	22890	33	31087	910	32472	178126	270535
IF	1035	1463	678	3443	807	3228	372	105310	2855	413099	1418	206	6857	540771
IL	733	86	201	274	146	227	24	30738	217	209167	8152	10	253	250228
IS	1389	1248	811	2552	785	2772	252	140606	595	568160	5015	74	29098	753357
MH	319	62	176	186	1217	186	44	30374	35	196817	2573	25	900	232914
MM	2931	249	730	654	1989	1428	17835	51564	88	319138	18317	12913	17653	445489
MS	8279	344	1512	1006	2015	4488	8324	58807	163	250781	10942	114345	39470	500476
NT	1362	189	752	443	488	466	251	58576	99	342506	2484	33	44033	451682
OT	738	83	48	274	302	190	46	36802	85	343599	448	14	216	382845
PH	3276	495	437	1446	843	1481	212	81240	368	593276	5330	152	1722	690278
SB	953	581	365	1336	2682	1720	4986	57591	151	299562	4601	3639	3791	381958
SJ	602	86	336	240	7845	687	4768	18810	30	126086	11948	34367	3904	209709
SM	806	105	550	423	2327	1566	19241	34835	62	152496	12767	50761	49946	325885
SV	2837	292	3021	544	2323	928	818	70781	93	492603	54583	58	5304	634185
TL	373	72	56	296	174	238	39	26847	3355	152672	382	8	438	184950
TM	1650	1562	1414	3503	8316	4108	5185	119478	918	420179	27266	6780	40703	641062
TR	3889	68	139	184	481	225	14	32815	61	284049	545	14	122	322606
VL	661	128	58	377	166	365	107	32929	88	305366	781	43	373	341442
VN	502	97	144	232	64	227	55	33258	78	287154	8069	12	3818	333710
VS	552	83	77	259	128	253	43	53253	26	310390	4126	19	3362	372571
Active Margin	65861	25485	23956	57229	103213	71430	115457	2658165	58347	14025064	404475	495433	741504	18845619

Note: Author's own processing

Table 2 reflects the relative distribution of the different religious denominations in Romania's counties, expressed as a percentage, and gives a more nuanced picture of the weights of the various religious groups in relation to the total population in each county.

From this perspective, the dominance of the Orthodox denomination, which in most counties' accounts for between 60% and 90% of the population, is clearly visible. In counties such as Olt, Vâlcea and Argeş, the proportion of Orthodox exceeds 89%, highlighting the deeply traditional

character of these regions. However, in counties such as Covasna or Harghita, the proportion of Orthodox is considerably lower, below 30%, reflecting the strong presence of other denominations such as Roman Catholics or Reformed. Another notable aspect is the significant share of minority denominations in some counties. In Harghita, Roman Catholics represent about 66% of the population, underlining the cultural and religious specificity of this region. The Reformed have an important presence in counties such as Covasna and Satu Mare, with figures exceeding 15% of the local population.

Emerging denominations, such as Adventists or Pentecostals, have a smaller share at national level, but are noticeable in some counties, such as Arad or Bihor, where Pentecostals represent up to 8% of the population. These data suggest a diverse religious dynamic in the western regions of the country.

The categories *No religion* and *Information not available* show higher values in urban counties and in economically developed regions such as Bucharest or Ilfov. In Bucharest, the proportion of those with "information unavailable" amounts to 27%, an indicator of the secularization trend and anonymity characteristic of big cities. In the Dobrogea counties of Constanța and Tulcea, Muslims represent an important demographic segment, with values of around 5-6%. This reflects the historical presence of Tatar and Turkish communities in this region.

This proportional distribution of denominations provides valuable insights for adapting business strategies to the local specificities. In counties with high religious diversity, companies could develop more inclusive policies and approach cultural diversity as an opportunity for growth. In regions dominated by a single denomination, marketing strategies and human resources need to be sensitive to prevailing religious values and traditions. Thus, the analysis of the proportions in this table highlights not only the religious structure of Romania, but also how it can influence various aspects of social and economic life, emphasizing the importance of religion as a shaping factor in business planning and management.

Table no. 2 Relative distribution of different religious denominations in the counties of Romania

County	Advent	Agnostic	No Religion	Atheist	Baptist	No Religi on	Greek Cath	No Available	Muslim	Orthodox	Pentec ostal	Reforme d	Roman Cath	Active Margin
AB	.001	.001	.001	.001	.010	.003	.024	.108	.000	.790	.023	.029	.009	1.000
AG	.001	.001	.001	.001	.001	.001	.000	.106	.000	.881	.006	.000	.001	1.000
AR	.010	.001	.004	.002	.031	.005	.008	.110	.001	.660	.083	.019	.068	1.000
B	.002	.006	.001	.011	.002	.010	.001	.276	.005	.673	.002	.001	.010	1.000
BC	.003	.000	.000	.001	.001	.001	.001	.138	.000	.691	.014	.000	.150	1.000
BH	.003	.001	.003	.002	.039	.005	.018	.097	.001	.539	.074	.145	.073	1.000
BN	.004	.000	.001	.001	.006	.002	.015	.092	.000	.755	.083	.032	.008	1.000
BR	.002	.000	.000	.001	.001	.001	.000	.123	.001	.864	.003	.000	.002	1.000
BT	.004	.000	.000	.001	.002	.001	.000	.096	.000	.865	.029	.000	.001	1.000
BV	.003	.002	.002	.005	.003	.006	.004	.156	.001	.750	.024	.016	.029	1.000
BZ	.004	.000	.000	.001	.000	.001	.000	.105	.000	.881	.006	.000	.001	1.000
CJ	.004	.004	.003	.008	.011	.011	.027	.153	.001	.631	.032	.086	.028	1.000
CL	.002	.000	.000	.001	.001	.001	.000	.107	.002	.877	.007	.000	.001	1.000
CS	.002	.000	.001	.001	.033	.002	.004	.138	.000	.730	.034	.002	.052	1.000
CT	.002	.001	.000	.003	.002	.003	.000	.173	.056	.750	.004	.000	.006	1.000
CV	.004	.000	.002	.001	.002	.005	.002	.081	.000	.210	.038	.319	.336	1.000
DB	.005	.000	.001	.001	.001	.001	.000	.091	.000	.885	.013	.000	.001	1.000
DJ	.002	.001	.000	.002	.001	.002	.000	.131	.001	.853	.005	.000	.001	1.000
GJ	.001	.000	.000	.001	.002	.001	.000	.093	.000	.893	.007	.000	.001	1.000
GL	.003	.001	.000	.002	.001	.002	.000	.144	.000	.829	.016	.000	.002	1.000
GR	.004	.000	.001	.001	.001	.001	.000	.105	.001	.882	.002	.000	.001	1.000
HD	.002	.001	.002	.002	.011	.004	.006	.134	.000	.753	.040	.014	.031	1.000
HR	.002	.000	.002	.001	.004	.007	.003	.085	.000	.115	.003	.120	.658	1.000
IF	.002	.003	.001	.006	.001	.006	.001	.195	.005	.764	.003	.000	.013	1.000
IL	.003	.000	.001	.001	.001	.001	.000	.123	.001	.836	.033	.000	.001	1.000
IS	.002	.002	.001	.003	.001	.004	.000	.187	.001	.754	.007	.000	.039	1.000
MH	.001	.000	.001	.001	.005	.001	.000	.130	.000	.845	.011	.000	.004	1.000
MM	.007	.001	.002	.001	.004	.003	.040	.116	.000	.716	.041	.029	.040	1.000
MS	.017	.001	.003	.002	.004	.009	.017	.118	.000	.501	.022	.228	.079	1.000
NT	.003	.000	.002	.001	.001	.001	.001	.130	.000	.758	.005	.000	.097	1.000
OT	.002	.000	.000	.001	.001	.000	.000	.096	.000	.897	.001	.000	.001	1.000
PH	.005	.001	.001	.002	.001	.002	.000	.118	.001	.859	.008	.000	.002	1.000

SB	.002	.002	.001	.003	.007	.005	.013	.151	.000	.784	.012	.010	.010	1.000
SJ	.003	.000	.002	.001	.037	.003	.023	.090	.000	.601	.057	.164	.019	1.000
SM	.002	.000	.002	.001	.007	.005	.059	.107	.000	.468	.039	.156	.153	1.000
SV	.004	.000	.005	.001	.004	.001	.001	.112	.000	.777	.086	.000	.008	1.000
TL	.002	.000	.000	.002	.001	.001	.000	.145	.018	.825	.002	.000	.002	1.000
TM	.003	.002	.002	.005	.013	.006	.008	.186	.001	.655	.043	.011	.063	1.000
TR	.012	.000	.000	.001	.001	.001	.000	.102	.000	.880	.002	.000	.000	1.000
VL	.002	.000	.000	.001	.000	.001	.000	.096	.000	.894	.002	.000	.001	1.000
VN	.002	.000	.000	.001	.000	.001	.000	.100	.000	.860	.024	.000	.011	1.000
VS	.001	.000	.000	.001	.000	.001	.000	.143	.000	.833	.011	.000	.009	1.000
Mass	.003	.001	.001	.003	.005	.004	.006	.141	.003	.744	.021	.026	.039	

Source: Author's own processing

Table 3 reflects the different religious denominations within each county in Romania, as a proportion of the total of each denomination. This approach emphasizes the regional specificity of the confessional distribution and provides a comparative perspective on the presence of each confession in the country's counties.

A major observable aspect is the significant variation in the distribution of denominations between counties. The Orthodox denomination, dominant at the national level, presents the highest relative weights in counties such as Olt, Vâlcea, and Teleorman, where the values significantly exceed the national average. In contrast, counties in Transylvania, such as Covasna and Harghita, have lower proportions of Orthodox, reflecting the specific confessional diversity of this region.

Transylvanian counties such as Cluj, Bihor and Sălaj show a significant presence of Roman Catholics and Reformed. In Harghita, Roman Catholics make up over 24% of the total population of their denomination, while in Covasna the Reformed make up over 12%. These figures underline the historical and cultural heritage of the region, influenced by the Hungarian populations. Emerging denominations, such as Adventists and Pentecostals, are predominantly represented in counties such as Arad and Bihor, where Pentecostals constitute over 8% of their total denomination. This shows a stronger religious dynamic in the western regions of the country. Atheists and agnostics have a disproportionately high presence in Bucharest and Ilfov, reflecting the influence of urbanization and secularization.

Counties in the Moldavian region reflect a religious structure overwhelmingly dominated by the Orthodox denomination, a characteristic that underlines the strong link between this region and traditional religious values. The high proportions of Orthodoxy, frequently exceeding 80% in counties such as Iași, Bacău, Neamț, Vaslui and Suceava, confirm this confessional hegemony. This uniformity is not only a demographic characteristic, but also an indicator of the cultural coherence and stability of community values in the region. Confessional diversity in the counties of Moldova is low, with other confessions, such as Greek Catholics, Roman Catholics or Reformed, having a marginal presence. Greek and Roman Catholics are significant only in certain areas, such as Suceava county, but their shares remain low in relation to the total population. On the other hand, Adventists and Pentecostals have a more visible representation in a few counties but remain minority denominations. There is also an almost non-existent concentration of the population of other denominations, such as Muslims or agnostics, which underlines the religious homogeneity of this region. This homogeneity creates favorable conditions for policies and economic strategies based on traditional values and social cohesion.

The region of Dobrogea, represented by the counties of Constanța and Tulcea, is uniquely distributed with a significant concentration of Muslims. Approximately 63% of the Muslim population in Romania is in Constanța, highlighting the specific historical and cultural characteristics of this area.

The categories *No religion* and *Information not available* are more pronounced in urban and economically developed counties such as Bucharest, Ilfov and Cluj. In Bucharest, for example, 39% of agnostics and 34% of atheists are reported, reflecting a diversification of religious beliefs in urban environments.

Table no. 3 The distribution of different religious denominations within each county in Romania

County	Advent	Agnostic	No Religion	Atheist	Baptist	No Religion	Greek Cath	No Available	Muslim	Orthodox	Pentecostal	Reformed	Roman Cath	Mass
AB	.007	.007	.019	.008	.030	.013	.066	.013	.002	.018	.018	.019	.004	.017
AG	.013	.011	.015	.014	.003	.011	.001	.022	.003	.035	.008	.000	.001	.030
AR	.063	.013	.062	.017	.121	.026	.026	.017	.006	.019	.083	.015	.037	.021
B	.048	.391	.085	.341	.028	.245	.021	.177	.137	.082	.009	.002	.024	.091
BC	.024	.009	.009	.009	.006	.008	.006	.031	.002	.030	.020	.000	.121	.032
BH	.029	.020	.058	.022	.207	.039	.086	.020	.005	.021	.100	.161	.054	.029
BN	.020	.005	.012	.005	.018	.009	.037	.010	.001	.016	.060	.019	.003	.016
BR	.009	.004	.004	.007	.004	.004	.000	.013	.005	.017	.002	.000	.001	.015
BT	.025	.004	.006	.005	.007	.005	.000	.014	.001	.024	.028	.000	.001	.021
BV	.026	.040	.043	.043	.016	.047	.017	.031	.005	.028	.032	.017	.020	.028
BZ	.025	.005	.004	.007	.002	.006	.000	.016	.001	.025	.006	.000	.001	.021
CJ	.042	.113	.075	.094	.074	.107	.155	.038	.012	.030	.053	.116	.025	.035
CL	.011	.003	.006	.005	.002	.003	.000	.011	.007	.018	.005	.000	.000	.015
CS	.006	.003	.012	.005	.077	.008	.009	.013	.001	.013	.021	.001	.017	.013
CT	.016	.026	.011	.034	.010	.024	.002	.042	.629	.035	.007	.000	.005	.035
CV	.012	.002	.012	.003	.004	.014	.004	.006	.000	.003	.018	.122	.086	.010
DB	.039	.008	.012	.010	.003	.007	.001	.016	.003	.030	.015	.000	.001	.025
DJ	.022	.016	.011	.019	.008	.013	.001	.029	.007	.036	.008	.000	.001	.032
GJ	.006	.003	.002	.004	.005	.003	.001	.011	.001	.020	.006	.000	.001	.017
GL	.024	.014	.008	.017	.003	.011	.001	.027	.004	.029	.019	.000	.002	.026
GR	.014	.004	.010	.005	.003	.003	.000	.010	.003	.016	.002	.000	.000	.014
HD	.012	.009	.026	.013	.039	.019	.018	.018	.002	.019	.035	.010	.015	.019
HR	.009	.003	.020	.004	.010	.027	.007	.009	.001	.002	.002	.066	.240	.014
IF	.016	.057	.028	.060	.008	.045	.003	.040	.049	.029	.004	.000	.009	.029
IL	.011	.003	.008	.005	.001	.003	.000	.012	.004	.015	.020	.000	.000	.013
IS	.021	.049	.034	.045	.008	.039	.002	.053	.010	.041	.012	.000	.039	.040
MH	.005	.002	.007	.003	.012	.003	.000	.011	.001	.014	.006	.000	.001	.012
MM	.045	.010	.030	.011	.019	.020	.154	.019	.002	.023	.045	.026	.024	.024
MS	.126	.013	.063	.018	.020	.063	.072	.022	.003	.018	.027	.231	.053	.027
NT	.021	.007	.031	.008	.005	.007	.002	.022	.002	.024	.006	.000	.059	.024
OT	.011	.003	.002	.005	.003	.003	.000	.014	.001	.024	.001	.000	.000	.020
PH	.050	.019	.018	.025	.008	.021	.002	.031	.006	.042	.013	.000	.002	.037
SB	.014	.023	.015	.023	.026	.024	.043	.022	.003	.021	.011	.007	.005	.020
SJ	.009	.003	.014	.004	.076	.010	.041	.007	.001	.009	.030	.069	.005	.011
SM	.012	.004	.023	.007	.023	.022	.167	.013	.001	.011	.032	.102	.067	.017
SV	.043	.011	.126	.010	.023	.013	.007	.027	.002	.035	.135	.000	.007	.034
TL	.006	.003	.002	.005	.002	.003	.000	.010	.058	.011	.001	.000	.001	.010
TM	.025	.061	.059	.061	.081	.058	.045	.045	.016	.030	.067	.014	.055	.034
TR	.059	.003	.006	.003	.005	.003	.000	.012	.001	.020	.001	.000	.000	.017
VL	.010	.005	.002	.007	.002	.005	.001	.012	.002	.022	.002	.000	.001	.018
VN	.008	.004	.006	.004	.001	.003	.000	.013	.001	.020	.020	.000	.005	.018
VS	.008	.003	.003	.005	.001	.004	.000	.020	.000	.022	.010	.000	.005	.020
Active Margin	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	

Source: Author's own processing

This analysis highlights the regional specificity of the confessional distribution in Romania and emphasizes the importance of understanding these dynamics for adapting social, economic and managerial strategies. In counties with high confessional diversity, organizational policies and marketing strategies should be customized to local specificities, promoting inclusion and respect for diversity. On the other hand, in regions with a clear confessional dominance, economic initiatives should be sensitive to prevailing religious values and traditions.

Table 4 presents the results of a factor analysis, providing information on the importance of different dimensions in explaining the variation in the data, using indicators such as singular values, inertia and cumulative inertia proportion. The first dimension is dominant, with a singular value of 0.535, indicating that it explains 28.6% of the total variation in the data. This dimension contributes significantly to the overall distribution of the data and has the highest inertia (proportion of information explained). It is evident that the first dimension captures the most relevant patterns in the dataset, probably related to the Orthodox denomination, which has a dominant share in the religious structure of Romania. The second dimension, with a singular value of 0.309, explains 9.5% of the total variance, and together with the first dimension, cumulatively, they cover 77.2% of the

variance. This dimension is related to variables indicating the confessional diversity specific to regions such as Transylvania, where other confessions (Roman Catholic, Reformed, Greek Catholic) are more present. The high value of the total Chi-square (9,322,236,668) and the statistical significance ($p < 0.001$) indicate a strong association between the analyzed variables, suggesting that the confessional structure of the counties is significantly related to the population characteristics and geographical distribution.

Table no. 4 Dimensions of factor analysis

Dimensio n	Singular Value	Inertia	Chi Square	Sig.	Proportion of Inertia		STD	Confidence Singular Value Correlation 2
					Accounted for	Cumulative		
1	.535	.286			.579	.579	.000	.227
2	.309	.095			.193	.772	.000	
3	.201	.040			.081	.853		
4	.163	.027			.054	.907		
5	.157	.025			.050	.957		
6	.110	.012			.025	.982		
7	.080	.006			.013	.994		
8	.042	.002			.004	.998		
9	.028	.001			.002	.999		
10	.015	.000			.000	1.000		
11	.007	.000			.000	1.000		
12	.003	.000			.000	1.000		
Total		.495	9322236.668	.000 ^a	1.000	1.000		

a. 504 degrees of freedom

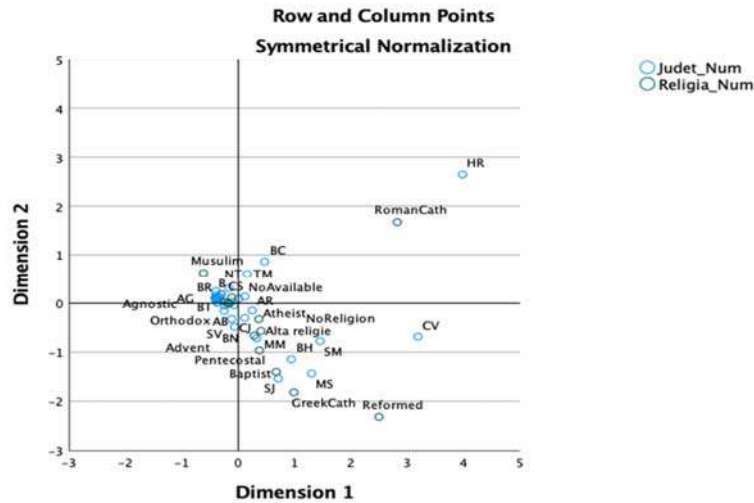
Source: Author's own processing

Figure 1 illustrates the relationships between Romania's counties and the predominant religious denominations, using a factorial representation based on symmetric normalization. The two main dimensions highlight the underlying structures of the data, allowing a visual interpretation of confessional distribution and regional specificity.

In dimension 1, minority denominations, such as Greek Catholics and Reformed, are associated with counties in Transylvania, a region known for its confessional pluralism. On the other hand, at the positive end of the same axis, the nationally dominant Orthodox denomination is linked to the southern and eastern counties, where religious uniformity is more pronounced. This axis thus provides a clear picture of the contrast between the confessional diversity of Transylvania and the predominantly Orthodox character of the southern and eastern regions. Dimension 2 differentiates between traditional and less represented denominations or between minority categories and regional specificity. The prominent position of Harghita County at the top of the figure indicates a close association with the Roman Catholics, emphasizing the uniqueness of this area in confessional and ethnic terms. Also at the top, categories such as Muslim or *Information not available* are closer to the center, suggesting a more balanced distribution in relation to the counties analyzed.

Overall, the figure 1 reflects Romania's religious diversity and regional differences. Transylvania is characterized by the presence of several historical denominations, such as Greek-Catholics and Reformed, while Dobrogea highlights specific cultural influences due to Muslim communities. In the south and east of the country, Orthodoxy dominates, emphasizing a more uniform confessional pattern. At the same time, in urban areas, such as Bucharest, there is a more pronounced association with non-traditional categories such as agnostics and atheists, indicating a trend towards secularization.

Figure no. 1 The relationships between Romania's counties and the predominant religious denominations



Source: Author's own processing

This visual representation emphasizes not only the confessional distribution, but also the deep connections between religion, geographical context and socio-cultural characteristics of each region. Thus, the figure provides a solid basis for more complex interpretations about the role of religion in shaping the regional specificity and social dynamics in Romania.

5. Conclusions

This study explored the confessional distribution in Romania's counties using factorial methods, highlighting how religion influences regional specificity and its impact on business management. The analysis revealed that Romania's confessional structure is deeply marked by geographical and cultural characteristics, reflecting both the dominant uniformity of the Orthodox denomination in the south and east of the country and the confessional diversity specific to Transylvania. These particularities are not only statistical but have significant implications for economic behavior, organizational strategies and managerial policies. The religious dimension is an essential component of the local culture, influencing community values and social relations, making it a key determinant of economic decisions. In counties with a high religious diversity, business strategies need to be more inclusive and adapted to the multicultural context, while predominantly orthodox regions favor organizational policies aligned with traditional values. Integrating the literature has highlighted the close link between religion and business ethics, social cohesion and corporate social responsibility. These elements are fundamental for sustainable development and for building economic models that respect local specificity. The analysis also showed that religion can act as a catalyst for innovation in resource management and strategic planning.

The results of this study highlight the need for a deeper understanding of regional religious dynamics to adapt business practices to cultural specificity. They provide a solid basis for the development of context-sensitive economic strategies promoting inclusion, sustainability and social cohesion. The study makes a valuable contribution to the interdisciplinary literature, highlighting the complex interaction between religion, economics and business administration.

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Childbirth, Marital Status and Religion: A Comparative Urban-Rural Perspective

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Abstract

This study explores the differences in marital status, childbirth, and religion between urban and rural environments, highlighting their impact on policy formulation and organizational strategies. Using a quantitative methodology, the analysis included paired sample statistics and effect sizes, applying Cohen's d and Hedges correction to assess the significance of these differences. The results indicate surprising uniformity across the means analyzed, with minor and statistically insignificant differences in nativity and marital status behaviors. These findings suggest the need for flexible and inclusive policies in both the public and private sectors that equally address the needs of people from both residential settings. The conclusion of the study emphasizes the importance of recognizing similarities in urban and rural environments in formulating effective development and human resource strategies, contributing to better social and economic cohesion.

Key words: childbirth, marital status, religion, residence environments

J.E.L. classification: M14, Z12, Z13.

1. Introduction

Childbirth, marital status and religion are factors that influence not only social but also labor market dynamics and organizational behavior. This research explores these factors in the context of comparisons between urban and rural residential environments, with the aim of exploring how possible differences may affect organizational practices and cultures.

Childbirth influences the labor market by altering the age structure of the active population, which has direct implications for recruitment, retention and career development strategies within organizations. By analyzing variations in childbirth between urban and rural areas, our study aims to identify how these trends may dictate organizational training, and adaptation needs in different geographical contexts.

Marital status, through the stability or instability it may suggest in employees' lives, also affects organizational performance. A thorough understanding of this aspect can provide companies with important data for developing employee supportive policies that contribute to increased job satisfaction and commitment (Aivaz, Mişa & Teodorescu, 2024).

In addition, religion, as a central element of individual and collective culture, can shape organizational values and workplace behavior (Aivaz & Petre, 2024). Different religious practices and beliefs which are present in urban and rural settings can influence work ethics, team cohesion, and even organizational politics (Petre & Aivaz & Aivaz, 2024). A better understanding of the impact of religion on the business environment can help formulate cultural management strategies that respect and enhance diversity.

By addressing these three factors - childbirth, marital status, and religion-in an urban-rural comparative perspective, our study aims to provide business leaders and Human Resources (HR) managers with a comprehensive perspective on how socio-demographic context can influence and shape organizational culture. This research is designed to support companies in creating work environments that are not only productive, but also inclusive and adapted to diverse social and cultural realities.

2. Literature review

Considering the literature, this study provides new insights and confirms some existing studies while highlighting discrepancies that may influence effective development policies.

The results of this study suggest that although religion has previously been correlated with higher birth rates in the work of Herzer (2019) and Hacker and Roberts (2017), in our case, we did not observe a statistically significant influence of religion on childbirth rates in direct comparison between urban and rural settings. This suggests that other variables, such as economic conditions or access to education, may play a more determinative role in contemporary birth rates decisions than religion.

Also, while Sorokowski et al. (2017) indicated that the number of children and the length of marriage influence marital satisfaction globally, in our research, these aspects did not differ significantly between urban and rural areas, indicating that relationship dynamics are uniform across the geographic environments analyzed.

The present study contributes to the existing literature by highlighting possible shifts in the traditional impact of religion on childbirth behavior, such as those discussed by Shaver et al. (2020) on the influence of religious community support on urban parents. While this support may play a vital role in child development in urban settings, cultural factors and access to community resources may be of comparable or even greater importance in decisions about birth rates and family structure.

Recent analyses (Coale, 2017; Kalmijn, 2013) provide essential context for understanding changes in family structure and birth decisions. These studies suggest that education and socioeconomic factors are key determinants of childbirth and marriage decisions, ideas that are also reflected in our findings on behavioral uniformity in urban and rural settings.

Hubert's (2014) work on the impact of religion on birth rates in several European countries, complementary to Bar-El et al.'s (2013) study which discuss secularization and the cultural transmission of religion, supports our understanding of the complex relationship between religion and childbirth. Both papers illustrate how religious values, and the degree of secularization can influence birth decisions, a point that resonates with our observations of insignificant variation in the impact of religion on births across the environments analyzed (Stan, Vancea & Zaharia, 2023; Stan & Vancea, 2013).

In addition, the analysis by Dribe et al. (2017) and Perrin (2022) studying the origins of the European demographic transition adds depth to the discussion of the influence of socioeconomic status and marital status patterns on birth rates. These historical insights are essential to contextualize contemporary changes in birth behavior and family structures. Also, Fuchs and Goujon's (2014) research conducted in high- childbirth countries and Puschmann and Solli's (2014) study of household and family dynamics during urbanization and industrialization provide valuable insights into how macroeconomic processes and changes in family structure influence childbirth. These papers highlight how economic change and urbanization have reshaped family traditions and childbirth decisions, themes that are consistent with our findings about the similarities between the two urban-rural environments.

Therefore, the integration of these works into the analysis not only increases the complexity and relevance of our study, but also emphasizes the importance of a comprehensive and interdisciplinary approach in formulating public policies that effectively respond to the diverse needs of the population in a changing social landscape. These connections between existing studies and our observations contribute to a deeper academic dialog and to the formulation of development strategies adapted to current demographic realities.

3. Research methodology

In this research, we applied a quantitative methodology to analyze and compare urban-rural differences in women's childbirth and marital status, using SPSS version 28 software to perform paired sample statistics. This approach allowed us to assess how demographic and social variables interact in different geographical contexts.

The analyzed data were extracted from national sources of demographic statistics (NSI), segmented into two main categories: urban and rural. We included in the study the female resident

population aged 11 years and over, divided into several subcategories according to birth and marital status. Thus, we examined the number of women who did not have live born children, as well as the total number of children born alive to unmarried, married, widowed and divorced women, for urban and rural settings.

The analysis was performed using the paired-samples statistical test, an appropriate technique for comparing the means of two related samples, in our case, the urban and rural segments for each data category. This method provides an accurate assessment of internal differences, allowing for a detailed interpretation of the impact of socio-demographic factors on birth and marital behavior.

Through this methodological approach, the study aims to provide a rigorous analysis of how urban and rural environments influence women's childbearing and marital status decisions, thus contributing to a better understanding of contemporary social dynamics.

4. Findings

Table 1, which presents a comparative urban-rural description of some of the variables on childbirth, marital status and religion, shows significant differences between the various denominations and marital status in the two settings. There is a predominance of the Orthodox population in both settings, with many women who have not given birth to live children, but also an impressive number of children born alive, especially among married women.

In urban areas, the proportion of women who have not given birth is higher than in rural areas, which could indicate a tendency to delay or even give up motherhood, possibly influenced by economic or career factors. Among Orthodox women in urban areas, almost one million are childless, while in rural areas the figure is lower, indicating a stronger adherence to traditional values regarding family and childbearing.

Interestingly, despite a lower childbirth rate among unmarried women in urban areas, the number of children born alive to unmarried women is significant in both environments, suggesting that traditional marital status is no longer exclusively linked to childbearing decisions. It is also notable that divorced and widowed urban women have higher childbirth rates than rural women, possibly due to better social and economic support in cities for these groups.

Analyzing the data by denomination, we observe that religious minority groups such as Pentecostals, Baptists and Old-Rite Christians have higher childbirth and marriage rates in rural compared to urban areas, reflecting adherence to more conservative cultural and religious practices.

These differences underline the complexity of the relationships between religion, marital status and childbirth decisions, showing that these variables are profoundly influenced by socio-cultural and economic context. Therefore, any policy or social intervention targeting these issues must consider the cultural and economic specificity of the environments of residence in order to be effective.

Table no. 1 Comparative urban-rural description of some of the variables on childbirth, marital status and religion

Religion/ Variables	PRFU	CVU	PRFR	CVR	CNVN U	CNVCU	CNVV U	CNVD U	CNVN R	CNVCR	CNV_V R	CNV_D R
Orthodox	3414977	960019	3195231	790195	375046	2514899	959561	527970	590707	3269048	1277941	258521
Romano-Catholic	168240	47622	181375	50214	20998	120320	58728	26756	32074	190963	79052	15188
Reformed	116373	29527	120454	29792	14378	84085	44153	17452	23264	110321	48041	10275
Pentecostal	59919	20167	107494	36661	9326	95673	18287	6769	23571	198315	32403	6098
Greek-Catholic	33650	9675	22411	5836	3418	19598	13944	6493	4361	21667	9805	2071
Baptist	26687	7916	23837	6316	2578	26076	8903	3987	3517	31310	9581	1889
Advent	11549	3411	20969	5398	1092	10339	3981	1785	2594	26920	7566	1587
Muslim	16719	5593	6548	1958	4010	13509	3929	2320	2552	6929	1704	479
Unitarian	10832	2754	11663	2835	1163	8166	3928	1831	2873	10384	4856	1054

Jehovah's Witnesses	14343	4227	9987	2421	1309	12832	5821	1841	1204	11964	4657	698
Christian according to the Gospel	8394	2887	8307	2541	772	10906	2835	1219	1710	13387	3621	520
Old Rite Christian	4294	1257	9018	2208	381	3722	1450	715	1273	10096	4019	711
Evangelical Lutheran	6421	1789	3279	854	573	4188	2497	1186	520	3174	1346	335
Serbian Orthodox	2807	757	3910	957	383	1741	788	450	870	3182	1350	427
Evangelical	2077	703	1523	482	202	2190	760	366	233	2264	532	127
Augustinian	1355	408	537	163	108	833	650	272	91	508	233	73
Mosaic	1061	369	130	53	62	390	395	270	26	148	29	12
Other religion	5983	2494	4071	1563	568	5489	1012	1001	523	4933	1160	393
No religion	18913	11502	5337	2590	1639	6560	1299	2792	1878	3508	460	574
Atheist	14673	9430	2374	1380	769	3595	907	2170	86	949	154	348
Agnostic	8546	6202	1153	741	371	1658	264	963	49	353	50	151
Information not available	759007	663494	298942	269940	8241	96341	31217	21870	2708	36067	10780	4896

Source: Author's own processing by SPSS

The significance of the variables coded in Table 1 is as follows:

PRFU = Female resident population aged 11 years and over in Urban

PRFR=Resident female population aged 11 and over in Rural

CVU = females aged 11 and over who have not given born children alive in urban areas

CVR = females aged 11 and over who have not born children alive in rural areas

CNVNU = Total number of children born alive to unmarried women in urban areas

CNVNR= Total number of children born alive to unmarried women in rural areas

CNVCU= Total number of children born alive to married women in urban areas

CNVCR= Total number of children born alive to married women in rural areas

CNVVU= Total number of children born alive to widowed women in urban areas

CNVVR= Total number of children born alive to widowed women in rural areas

CNVDU= Total number of children born alive to divorced women in urban areas

CNVDR= Total number of children born alive to divorced women in rural areas

Analysis of the data in Table 2 reflects several differences and trends in demographic behavior between urban and rural environments. These differences are illustrated by comparing the means of key indicators related to childbirth and marital status in these two environments.

First, the female resident population over 11 years of age (PRFU and PRFR) shows a higher average in urban compared to rural, indicating a higher concentration of women in cities.

For women aged 11 and over who have not given born children (CVU and CVR), we observe a higher average in urban areas. This may reflect a tendency in urban areas to delay or even avoid motherhood, possibly for economic or social reasons such as education or career.

An analysis of the total number of children born to unmarried women (CNVNU and CNVNR) shows a higher average in rural areas, which could indicate a wider acceptance or higher incidence of out-of-wedlock childbirths in these communities compared to urban ones.

If we look at the number of children born to married women (CNVCU and CNVCR), we observe that the average is significantly higher in rural areas. This points to a greater valorization of the traditional family and the role of motherhood among rural married women.

The differences between widowed women in the number of children born alive (CNVVU and CNVVVR) are also higher in rural areas, suggesting that widowhood does not necessarily reduce the chances of having children in those communities.

Analyzing the number of children born to divorced women (CNVDU and CNVDR), we see that the average is higher in urban areas, indicating that divorced women in cities may be more likely to have children than those in rural areas, possibly due to more robust social or economic support in cities for single mothers.

These data provide us with a detailed insight into how marital status and geographical context influence childbearing decisions and family structures, reflecting significant cultural and economic variations between urban and rural areas. This analysis is essential for understanding current social dynamics and for planning social and economic policies that respond effectively to the needs of different demographic groups.

Table no. 2 Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PRFU	213946.36	22	732900.232	156254.855
	PRFR	183570.45	22	676774.206	144288.745
Pair 2	CVU	81463.77	22	241020.903	51385.829
	CVR	55231.73	22	173899.599	37075.519
Pair 3	CNVNU	20335.77	22	79404.855	16929.172
	CNVNR	31667.45	22	125179.720	26688.406
Pair 4	CNVCU	138323.18	22	532093.755	113442.770
	CNVCR	179835.91	22	692382.324	147616.408
Pair 5	CNVVU	52968.59	22	203085.247	43297.920
	CNVVR	68151.82	22	270889.359	57753.805
Pair 6	CNVDU	28658.09	22	111765.120	23828.404
	CNVDR	13928.50	22	54761.983	11675.294

Source: Author's own processing by SPSS

The results presented in Table 3 on the differences between urban and rural environments in terms of childbirth and marital status revealed that although there is variation between these environments, the differences are not statistically supported at a significant level. This indicates a surprising uniformity in demographic behavior, with socioeconomic and cultural factors influencing childbirth and marital status decisions across the country.

From a business management perspective, these findings underscore the importance of recognizing and understanding the needs of employees from diverse geographic backgrounds as similar. In an increasingly diverse and integrated corporate world, human resource policies should reflect this broad spectrum of commonality by accommodating employees' needs for job flexibility, family benefits, and parental assistance programs, regardless of their urban or rural location.

Sociologically, the uniformity indicated by these results are a signal that traditional and modern values similarly influence urban and rural communities. Although urbanization continues to alter the social and economic landscape, core values related to family and interpersonal relationships remain remarkably constant. This could be explored in community initiatives and public policies aimed at improving quality of life in all areas.

Economically, the lack of a significant urban-rural difference in these areas is an indication that the economic factors influencing childbirth and marriage decisions are evenly distributed. This could imply a balanced distribution of economic opportunities or challenges in different areas, which should be considered in economic planning and regional development.

Table no. 3 Paired Samples Test

	Paired Differences					t	df	Significance	
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				One-Sided p	Two-Sided p
				Lower	Upper				
Pair 1 PRFU - PRFR	30375.90	107543.30	22928.30	-17306.119	78057.93	1.32	21	.100	.199
Pair 2 CVU - CVR	26232.04	89729.73	19130.44	-13551.890	66015.98	1.37	21	.092	.185
Pair 3 CNVNU CNVNR	-11331.68	45842.13	9773.575	-31656.944	8993.58	-1.15	21	.130	.259
Pair 4 CNVCU CNVCR	-41512.72	161996.33	34537.73	-113337.876	30312.42	-1.20	21	.121	.243
Pair 5 CNVVU CNVVR	-15183.227	68099.170	14518.792	-45376.708	15010.253	-1.046	21	.154	.308
Pair 6 CNVDU CNVDR	14729.591	57047.791	12162.630	-10563.983	40023.164	1.211	21	.120	.239

Source: Author's own processing by SPSS

From a cultural perspective, the results show that there is a common cultural basis that transcends these geographical divisions. This finding can inspire stronger cultural integration initiatives and help shape a cohesive national identity that values diversity within a framework of similarity.

In conclusion, although the results do not show significant differences, they provide valuable insights for understanding national uniformity in demographic behavior and marital status. This understanding could be used to support decisions in business management, socioeconomic planning, and cultural initiatives, promoting policies that are relevant and effective for all segments of society.

Table no. 4 Paired Samples Effect Sizes

			Standardizer ^a	Point Estimate	95% Confidence Interval	
					Lower	Upper
Pair 1	PRFU - PRFR					
		Cohen's d	107543.301	.282	-.147	.706
Pair 2	CVU - CVR					
		Hedges' correction	111584.645	.272	-.142	.680
Pair 3	CNVNU - CNVNR					
		Cohen's d	89729.734	.292	-.138	.716
Pair 4	CNVCU - CNVCR					
		Hedges' correction	93101.667	.282	-.133	.690
Pair 5	CNVVU - CNVVR					
		Cohen's d	45842.131	-.247	-.669	.180
Pair 6	CNVDU - CNVDR					
		Hedges' correction	47564.822	-.238	-.645	.174
Pair 7	CNVVCU - CNVVCNR					
		Cohen's d	161996.330	-.256	-.678	.172
Pair 8	CNVVCU - CNVVCNR					
		Hedges' correction	168083.952	-.247	-.654	.165
Pair 9	CNVVU - CNVVNR					
		Cohen's d	68099.170	-.223	-.644	.203
Pair 10	CNVVU - CNVVNR					
		Hedges' correction	70658.253	-.215	-.620	.195
Pair 11	CNVDU - CNVDNR					
		Cohen's d	57047.791	.258	-.170	.680
Pair 12	CNVDU - CNVDNR					
		Hedges' correction	59191.576	.249	-.164	.656

a. The denominator used in estimating the effect sizes.

Cohen's d uses the sample standard deviation of the mean difference.

Hedges' correction uses the sample standard deviation of the mean difference, plus a correction factor.

Source: Author's own processing by SPSS

The effect size results for comparing demographic behaviors and marital status between urban and rural environments, as reflected by Cohen's d and Hedges correction in Table 4, indicate relatively small differences. These small variations suggest that although there are absolute differences between urban and rural in terms of childbirth and marital status, they are not significant. Thus, family-related behaviors and birth decisions are surprisingly similar between the two environments.

From a business management perspective, the uniformity indicated by the small effect sizes between urban and rural environments highlights the importance of implementing similar organizational policies (Stan & Cortel, 2022). These policies should address the diversity of employees' family situations, recognizing that employees' needs in terms of parental support and work-life balance are similar regardless of the environment. Organizations would benefit from adaptability in addressing employees' needs through parental support programs and *work-life balance* initiatives that need to be adaptable enough to cover a broad spectrum of situations (Aivaz, 2021).

At the sociocultural level, effect sizes reflect a consistency in family-related norms and practices, indicating that traditional family-related values are deep-rooted and influence behaviors in comparable ways in different geographical contexts. Thus, community development strategies and public policies could benefit from an integrated approach that capitalizes on similarities across residential environments to create greater and more coherent impact at the national level (Herciu et al., 2023). This holistic approach could facilitate better social integration and more effective application of resources in development initiatives at community and national levels.

5. Conclusions

The study provides a comprehensive perspective on the uniformity of family-related behaviors and childbirth decisions in two geographic contexts. The analysis showed that, despite expectations of significant urban-rural differences, the variations are in fact subtle and do not reach a threshold of statistical significance indicating profound differences.

The implications of this uniformity are important for the formulation of public policies and corporate strategies. Policies and programs designed to support families and employees should recognize the cross-sectional similarity and be designed to address the needs of people from both backgrounds equally. Parenting support programs and initiatives promoting work-life balance should accommodate these similarities, thus avoiding the creation of fragmented policies that may neglect or underestimate essential commonalities. At the socio-cultural level, the results show that traditional and modern values uniformly influence communities.

Therefore, this research illustrates how a thorough understanding of demographic structures and marital status behaviors in different settings can reflect key aspects of social and economic structure, thus providing a solid evidence base for public policy and business decisions.

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Can The Fragility of States Influence The Relationship Between Economic and Human Development?

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Abstract

The institutional governance of countries is a subject intensely explored in recent literature, particularly regarding the influence that governance exerts on economic and social equilibrium. This study investigates the influence that the fragility of nation states has on the link between human and economic development of 129 states, between 2008 to 2022. Basic regression techniques and static panel methods are used (Pooled OLS, Robust regression, Fixed and random effects, Panel-corrected standard errors regression, Prais-Winsten regression) and the Fragile State Index captures the states fragility in terms of social, economic and social challenges. Empirical findings indicate that the more fragile the states, the lower the level of human development, while economic prosperity and government spending lead to improved human development. This study is helpful for policymakers and government authorities to whom it presents evidence of the importance of reducing the fragility of countries, as a premise for human and economic development.

Key words: governance, state fragility, economic growth, human development, government expenditure

J.E.L. classification: O11, O15, H53

1. Introduction

In humanity's efforts to improve people socio-economic conditions, the Sustainable Development Goals are important in guiding the public policies of nation states for the 2030s agenda (United Nations, 2024; Mombeuil and Diunugala, 2021, p. 311). Specifically, 17 Sustainable Development Goals have been adopted by the United Nations countries in 2015 and they include the major themes of human, economic, social and environmental development that contemporary society is facing. Under SDG 1, poverty eradication is a goal aimed at changing the status of groups vulnerable to poverty. SDG 3 identifies the goal of ensuring a healthy life for individuals and promoting their well-being at any age, against the background of major discrepancies between different regions of the world in the field of healthcare and different opportunities for access to health services. SDG 4 promotes quality, inclusive and equitable education, which can make a major contribution to changing life expectancy for the better and to the development of numeracy or literacy skills, considered premises for harmonious human development. The encouragement of sustainable economic growth, proclaimed by SDG 8, aims to support the growth of GDP per capita, labour productivity, employment measures and reduction of unemployment. SDG 16 proclaims the importance of a peaceful society with effective, accountable and inclusive institutions at all levels. From the brief description of these objectives provided by the Sustainable Development Goals, it follows that the themes of human development, economic growth and state governance are part of the contemporary concerns of governments, aware of the importance of configuring public policies that target these essential objectives.

The Human Development Index (HDI) is built to provide a development measure, based on three categories of indicators, referring the longevity, education and income (Luchters and Menkhoff, 2000, p. 267). The indicator has gained a consistent reputation over time and has even become a competitor of the Gross Domestic Product (GDP) in characterizing the degree of development of nation states (Kalimeris et al, 2020, p. 1; Unnikrishnan and Jagannathan, 2015, p. 19). However, GDP retains the supremacy in the doctrinal struggle over welfare and well-being indicators, even if the HDI valences make it suitable for highlighting the area of human development, essential in the general equation of country development. On the other hand, the human and economic development of countries cannot be conceived without strong institutions, governance playing an essential role in ensuring the economic and social balance of contemporary societies (Massuga et al., 2024, p. 28567; Ha et al., 2023, p. 610).

Developing on this understanding, this study intends to explore a critical research question: *Does the state fragility affect the relationship between economic and human development?*

The aim of the study is to investigate the relationship between economic and human development with the mediator effect of the countries' governance, respectively of the fragility of the states. We add some control variables referring to the demographic conditions, the dependent persons and the degree of urbanization. The research includes 129 countries during the period 2008-2022. The main findings of this study can be summarized as follows: economic development leads to higher human development and enhancements in governance, more precisely, a decrease in the fragility of states contribute to growth in human development. These findings turn together the topics and evidence presented, presenting a comprehensive view of the subject matter.

This paper aids to literature on economic and human development, respectively governance, in several senses. First, it connects in a holistic manner these major topics on economic and human development, over a considerable period and many states. Second, this study considers the effect that governance in terms of state fragility has on the relationship between economic and human development. Third, this study explores the impact on human development of variables regarding the demographic conditions, as age dependency ratio and urbanization. This approach provides useful insight for policymakers on the influences and mechanisms by which economic development and governance affect human development.

The paper is organised on the succeeding sections: literature review, data and research methodology, results and discussions, conclusions and bibliographical citations.

2. Literature review

Based on a prior literature, this section describes the theoretical background of the linkage between human development, economic growth and countries' governance.

The governance of nation states positively influences human development, which in the past was improved through economic growth, and in the current period it is improved through government performance (Stylianou et al., 2023, p. 3). The way in which nation states are managed, economically, socially and politically, affects the level of human development, because education and health policies are the prerogative of governments, responsible for their adequate development and implementation. In addition, governments that succeed in developing economic policies with a positive impact on economic growth contribute to raising the population's standard of living. At the political and security level, good governance ensures a climate for human development.

This circumscribes the first hypothesis of the research:

Hypothesis 1 (H₁): Countries governance provides premises for increasing the level of human development.

The causal relation between economic and human development is often investigated in the recent studies, that considers the Gross Domestic Product as an essential indicator of economic development and also as a measure of well-being (Dedecek and Dudzich, 2022, p. 193). Although there are opinions that conceptually differentiate economic development from economic growth and a consensus cannot be identified on the meaning of the mentioned terms, Gross Domestic Product per capita is often considered as a proxy for welfare performance or for the relative efficiency of an economy, despite the new wave of the "new welfare" theory and against the backdrop of the myopic approach to GDP as an welfare indicator (Kalimeris et al, 2020, p. 1).

The Human Development Index (HDI) issued by the United Nations Development Programme (2024) is considered a major indicator for assessing a nation's overall standard of living and well-being (Ogujiuba et al., 2024, p. 527). The dimensions that HDI captures refer to a combination of variables that render the quality of life in terms of health and longevity, through life expectancy, complemented by indicators specific to education, through the number of real and expected years of school, as well as a dimension of individuals' income, which ensures the premises of a decent standard of living.

A positive relationship between GDP and HDI is confirmed by previous studies, which demonstrate that GDP contributes to the increase of national income (Kizilkaya et al., 2024, p. 186), to the decrease of unemployment and the increase of wages, given that people choose to spend money on education, food and health, which contribute directly to human development (Khan et al., 2019, p. 19294).

Another macroeconomic indicator, represented by government expenditure, plays an important role in development, through the impact it has on the growth of HDI, through mechanisms to reduce poverty, reduce inequalities, increase the income of individuals, reduce unemployment and a spike in economic growth (Masduki et al., 2022, p. 1). Public social expenditure, referring the health, education and social protection spending, reduces the inequalities, inequity in education, life expectancy and income distribution, which leads to the increase of HDI (Miranda-Lescano et al., 2024, p. 363).

Considering these, we can formulate the following hypothesis of this study:

Hypothesis 2 (H_2): Rising GDP per capita lead to increased human development.

Hypothesis 3 (H_3): Government expenditure contributes to the growth of human development.

3. Research methodology

This section describes data and methodology used to explore the mediator effect of countries governance on the relationship between human and economic development. We use a global data panel between 2008 to 2022, consisting of 129 countries, whose selection was made based on the available data. The list of these countries is presented in Appendix 1, while Table no. 1 shows the source of the data.

Table no. 1 Variables and data sources

Variables	Description	Data source
HDI – Human Development Index	Index based on several indicators: long and healthy life (Life expectancy at birth), knowledge (Expected years of schooling, Mean years of schooling) and a decent standard of living (GNI per capita PPPUSD) Score: 0 (low) – 1 (high)	United Nations Development Programme (2024)
GOVERNANCE - Fragile State Index	Index developed on social indicators (Demographic pressures, Refugees and internally displaced persons, Group grievance, Human flight and brain drain), economic indicators (Uneven economic development, Economic decline, Poverty and economic disparity) and political indicators (State legitimacy, Public services, Human rights and rule of law, Security apparatus, Factionalized elites, External intervention) Score: 0 (stability) – 120 (instability)	Fund for Peace, Fragile State Index (2024)
GDPPP - Gross domestic product per capita	Gross domestic product per capita, constant prices, Purchasing power parity; 2017 international dollar, Units	International Monetary Fund, The World Economic Outlook (WEO) database (2024)
GOV_EXP – Government expenditure to GDP	General government total expenditure, Percent of GDP	International Monetary Fund, The World Economic Outlook (WEO) database (2024)

DEPENDENCY – Age Dependency Ratio	Percentage of working-age population (proportion of dependents per 100 working-age population), the ratio of dependents, represented by people younger than 15 or older than 64, to the working-age population (those ages 15-64)	World Bank, World Development Indicators (2024a)
URBAN - Urban population	Percentage of total population, people living in urban areas, percentage of total population	World Bank, World Development Indicators (2024b)

Source: Author's processing in STATA

The variables used are chosen based on the previous literature (presented in the previous section), which considers the Human Development Index (HDI) as a reference index of human development, that captures indicators on a long and healthy life, education and income of individuals. HDI is the dependent variable of the model, and the core explanatory variables are the following:

- To manage the governance of nation states, the Fragile State Index (GOVERNANCE) developed by the Fund for Peace is used, which is a composite index based on a mix of social, economic and political variables.
- Economic development is examined using GDP per capita (GDPPP), which illustrates the economic performance of states and reflects their prosperity.
- Government expenditure (GOV_EXP) is employed to provide information on government efforts to achieve the economic and social objectives of the countries being studied.

Prior research in human development area allows the identification of two control variables used to highlight demographic aspects regarding age dependency ratio (Putkaradze et al., 2020, p. 89) and urbanization (Tripathi, 2021, p. 1053). To determine the influence that the state's involvement has in supporting vulnerable groups, age dependency ratio is used (DEPENDENCY) and to capture the influence that demography has on human and economic development, the urban population percentage indicator is used (URBAN).

The descriptive statistics of the variables are presented in Table no. 2, from which it follows that for all the variables used, there is a high heterogeneity between states, given that the ranges of values of the indicators register large differences between their minimum and maximum. The heterogeneous nature of the data lies in the fact that the countries studied are classified in all categories of economic development in terms of income (high, medium and low) and present differences in terms of human and economic development. In terms of human development, the HDI index is between 0.318 and 0.967, with an average of 0.726 and a standard deviation of 0.160, which shows a significant dispersion from the average. The analysis of the evolution of the degree of fragility of nation states, quantified by the Fragile State Index, shows a very wide range of values of the fragility of governance from the minimum of 14,630 (which denotes the most solid states) to the maximum of 114 (which shows the most fragile state), in terms of social indicators regarding demographic pressures and the structure of demographic groups, economic indicators and the degree of poverty, as well as political indicators, referring to public services, state legitimacy, rule of law etc. The same situation of heterogeneity between states is valid for the variables that render economic development (GDPPP, GOV_EXP), as well as for the variables that present the demographic situation of people dependent on government support and the degree of urbanization (DEPENDENCY and URBAN).

Table no. 2 Descriptive statistics of the variables

Variables	N	Min	Max	Mean	Std. dev.
HDI	1935	0.318	0.967	0.726	0.160
GOVERNANCE	1935	14.630	114	65.580	24.583
GDPPP	1935	6.863	11.695	9.426	1.161
GOV_EXP	1935	3.790	66.44	31.404	12.053
DEPENDENCY	1935	16.172	109.24	58.650	17.203
URBANIZATION	1935	15.326	100	60.428	22.403

Source: Author's own processing based on data from table no. 1

To determine the impact of governance and economic development on human development, this study gradually performs the following basic regression techniques and panel static models in STATA (Pooled OLS, Robust regression, Fixed and random effects, Panel-corrected standard errors regression, Prais-Winsten regression), based on the equation:

$$HDI_{i,t} = \alpha_0 + \alpha_1 GOVERNANCE_{i,t} + \alpha_2 GDPPP_{i,t} + \alpha_3 GOV_EXP_{i,t} + \alpha_4 DEPENDENCY_{i,t} + \alpha_5 URBAN_{i,t} + u_{i,t} \quad (1)$$

where i represents the country, t is the period (years), *variables* as they are set in *Table no 1*, α_0 is constant (intercept), $\alpha_{1,2,3,4,5}$ are the coefficients of the estimated parameters and $u_{i,t}$ is the error term.

4. Results and discussions

First, to verify the data validity and the robustness of the regressed results of the study, the basic classical linear regression model expectations are tested. The stationarity of data (*Table no. 3*) is based on the Levin-Lin-Chu tests, appropriate for available panel data (Levin et al., 2002, p. 1), whose results show that the null hypothesis is rejected that all panels contain unit roots.

Table no. 3 Stationarity of the variables

Variables	LLC test (Levin-Lin-Chu unit root test)	Conclusion
HDI	-18.740***	Stationarity
GOVERNANCE	-10.142***	Stationarity
GDPPP	-10.423***	Stationarity
GOV_EXP	-20.769***	Stationarity
DEPENDENCY	-28.270***	Stationarity
URBAN	-8.996***	Stationarity

Notes: ***, ** and * denote significance at 1, 5 and 10 percent level respectively.

Source: Author's own processing based on data from table no. 1

Second, we test the multicollinearity between variables (*Table no. 4*), whose conclusions denote that the variables are not correlated (except for HDI and GDPPP for which the value of the correlation coefficients is high, but explainable by the meaning of the variables and the interaction between them).

Table no. 4 Correlation matrix of the variables

Variables	HDI	GOVERNANCE	GDPPP	GOV_EXP	DEPENDENCY	URBAN
HDI	1.00					
GOVERNANCE	-0.85	1.00				
GDPPP	0.96	-0.84	1.00			
GOV_EXP	0.64	-0.62	0.61	1.00		
DEPENDENCY	-0.77	0.55	-0.74	-0.40	1.00	
URBAN	0.78	-0.68	0.81	0.50	-0.57	1.00

Source: Author's own processing based on data from table no. 1

We prove heteroskedasticity of data (*Table no. 5*), based on the White, Cameron & Trivedi (Cameron and Trivedi, 1990) and the Breusch-Pagan (Breusch & Pagan, 1979) tests.

Table no. 5 Results of heteroscedasticity and autocorrelation analysis

Test	Chi2 / F-stat	p-value	Result	Conclusion
White's test	433.77	0.000	Reject H ₀ : Homoscedasticity	Heteroscedasticity
Breusch-Pagan test	21.44	0.000	Reject H ₀ : Constant variance	Heteroscedasticity
Wooldridge test	21.70	0.000	Reject H ₀ : No first order autocorrelation	Serial correlation

Source: Author's own processing based on data from table no. 1

The serial correlation (Table no. 5) is explored through the Wooldridge test (Wooldridge, 2002, p. 1), which demonstrates that the null hypothesis of no serial correlation is declined and that there is serial correlation in data.

All the variables are normally distributed, based on skewness and kurtosis probabilities (Table no. 6).

Table no. 6 Skewness and kurtosis tests for normality

Variables	Pr(Skewness)	Pr(Kurtosis)	Adj chi2
HDI	0.000	0.000	253.67***
GOVERNANCE	0.000	0.000	280.61***
GDPPP	0.000	0.000	301.63***
GOV_EXP	0.000	0.000	146.63***
DEPENDENCY	0.000	0.000	158.09***
URBAN	0.000	0.000	291.66***

Notes: ***, ** and * denote significance at 1, 5 and 10 percent level respectively.

Source: Author's own processing based on data from table no. 1

There are premises of a long-term relationship between the studied variables (Table no. 7), as shown by the applied cointegration tests (Kao, 1999, p. 1; Pedroni, 2004, p. 597; Westerlund, 2005, p. 297).

Table no. 7 Cointegration of the variables

Kao cointegration test	Statistic	Pedroni cointegration test	Statistic	Westerlund cointegration test	Statistic
Modified Dickey-fuller t	3.046***	Modified Phillips-Perron t	13.209***	Variance ratio	-2.695***
Dickey-fuller t	0.634	Phillips-Perron t	-11.345***		
Augmented Dickey-fuller t	1.157	Augmented Dickey-fuller t	-9.868***		
Unadjusted modified Dickey-fuller t	1.730**				
Unadjusted Dickey-fuller t	-0.538				

Notes: ***, ** and * denote significance at 1, 5 and 10 percent level respectively.

Source: Author's own processing based on data from table no. 1

Cross-sectional dependence analysis (Table no. 8), based on the Pesaran test (Pesaran, 2004, p. 1) denotes that data are cross-sectionally dependent.

Table no. 8 Cross-sectional dependence between the variables

Variables	Pesaran test	Result	Conclusion
HDI	279.53***	Reject H ₀ : cross-section independence	Cross-sectional dependence
GOVERNANCE	128.41***	Reject H ₀ : cross-section independence	Cross-sectional dependence
GDPPP	184.27***	Reject H ₀ : cross-section independence	Cross-sectional dependence
GOV_EXP	60.78***	Reject H ₀ : cross-section independence	Cross-sectional dependence
DEPENDENCY	2.40**	Reject H ₀ : cross-section independence	Cross-sectional dependence
URBAN	na	na	Cross-sectional dependence

Notes: ***, ** and * denote significance at 1, 5 and 10 percent level respectively; na – not applicable.

Source: Author's own processing based on data from table no. 1

Several important findings arise from the regression methods displayed in Table no. 9. First, it follows that all variables are statistically significant and exerts influence on the dependent variable, represented by HDI.

Table no. 9 Results of interactions between human development, economic development and governance

Dependent variable - HDI	OLS – Pooled OLS	RE - Robust regression	FE – Fixed effects	RE – Random effects	PCSE – Panels corrected standard errors	PRAIS – Prais - Winsten regression
GOVERNANCE	-0.0010***	-0.0010***	-0.0004***	-0.0005***	-0.0010***	-0.0002***
GDPPP	0.0909***	0.0902***	0.0851***	0.0879**	0.0909***	0.0898***
GOV_EXP	0.0009***	0.0011***	0.0001**	0.0001***	0.0009***	0.0001***
DEPENDENCY	-0.0014***	-0.0015***	-0.0002***	-0.0005***	-0.0014***	-0.0010***
URBAN	0.0001*	0.0002***	0.0037***	0.0022***	0.0001***	0.0014***
Constant	-0.0158	-0.0147	-0.2658***	-0.1785***	-0.0158	-0.1382**
R ²	0.95	-	0.87	0.91	0.95	0.96
Hausman test	-	-	0.000		-	-

Source: Author's own processing based on data from table no. 1

The improvement of the governance of the analysed states, more precisely the decrease of the fragility of the countries, leads to the improvement of the level of human development, which confirms the **H₁ hypothesis** (which assumed that enhanced governance would lead to improved human development). The more the fragility of the state is mitigated and the institutions become resilient (they are properly controlled, led and empowered), the more the premises for improved human development are created, as citizens benefit from quality health services and education. In addition, in states where fragility is decreasing, conditions are created for higher incomes per person, prosperity and reduction of inequalities, which contributes to the improvement of human development.

The results reveal that increasing GDP per capita has a positive and significant impact on human development in the sample countries. These results confirm that **H₂ hypothesis** can be accepted. Hypothesis H₂ implied that rising GDP per capita leads to increased human development. The positive influence that GDP per capita has on HDI can be explained by the fact that economic growth leads to job creation, reduction of poverty and unemployment, which creates conditions for citizens to obtain income and greater social stability, contemptuous of sustainable human development. Economic growth allows governments to invest in health and education, both in infrastructure and in the quality of services, and thus creates the opportunity to achieve the health and education conditions specific to human development.

We find that the growth of government expenditure contributes to the growth of human development, thus validating the **H₃ hypothesis**. Hypothesis H₃ referred to the fact that increasing government spending generates higher human development. Government spending provides support programs and infrastructure in education and health, as well as public services that contribute to human development. Governments can allocate funds for job creation programs, social programs, support for vulnerable groups or reduction of inequalities.

As regards the control variables, it is found that the age dependency ratio negatively influences human development, given that an increase in the number of people who are dependent on government support, in relation to the population able to work, leads to a deprivation of public resources that could generate benefits in terms of education, health or income for citizens in general. Urbanization positively contributes to human development, as urban areas benefit from easier access to health and education infrastructure, as well as economic opportunities related to jobs. Quality of life, cultural services and sustainable urban development contribute significantly to human development.

5. Conclusions

The study explores the relationship between economic and human development with governance as mediator, using a worldwide panel data with 129 countries, between 2008 and 2022. The results were obtained in STATA through the following basic regression techniques and panel static models in STATA: Pooled OLS, Robust regression, Fixed and random effects, Panel-corrected standard errors regression and Prais-Winsten regression.

We consider the Human Development Index as a reference index of human development, that captures indicators on a long and healthy life, education and income of individuals. To discover the governance of nation states, the Fragile State Index developed by the Fund for Peace is used, which is a composite index based on a mix of social, economic and political variables. Economic development is explored using GDP per capita, which proves the economic performance of states and reflects their prosperity. Government expenditure is employed to display national efforts to achieve the economic and social objectives of the countries being studied. Two control variables are engaged to emphasize demographic aspects regarding age dependency ratio and urbanization.

We find that governance, quantified by the decrease in the fragility of countries contributes to the improving in human development, in line with the previous literature which emphasized the importance of governance in human development. Also, increasing GDP per capita and government expenditure has a positive and significant impact on human development in the sample countries. An enhance in the percentage of dependent population (under the age of 15 or over 64 years of age) worsens the general degree of human development, by depriving public resources to support these groups of dependent persons. Also, we prove that urbanization positively contributes to human development.

This study has theoretical and practical implications. Each government is responsible for ensuring good governance and premises for human and economic development. This study's results are helpful for policymakers to understand the relationship between governance, human and economic development. Other general categories directly involved in the studied issues are citizens, whose concerns are related to the trinomen - governance, human and economic development - essential for a high quality of life.

The limits of the study refer to the number of countries analyzed, period and indicators studied. Future research directions plan to expand the study to another states, obtain data as close as possible to the recent period and add new variables that could be appropriate in the analysis.

Appendix 1. List of studied countries: Afghanistan, Albania, Argentina, Armenia, Australia, Austria, Azerbaijan, Bahrain, Bangladesh, Belarus, Belgium, Benin, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, Burkina Faso, Cambodia, Cameroon, Canada, Chad, Chile, China, Colombia, Costa Rica, Croatia, Cyprus, Czechia, Denmark, Dominican Republic, Ecuador, El Salvador, Estonia, Ethiopia, Finland, France, Gabon, Georgia, Germany, Ghana, Greece, Guatemala, Guinea, Haiti, Honduras, Hungary, Iceland, India, Indonesia, Iraq, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Korea Rep., Kuwait, Kyrgyz Republic, Lao PDR, Latvia, Lebanon, Lesotho, Liberia, Lithuania, Luxembourg, Madagascar, Malawi, Malaysia, Mali, Malta, Mauritania, Mauritius, Mexico, Moldova, Mongolia, Montenegro, Morocco, Mozambique, Myanmar, Nepal, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, North Macedonia, Norway, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Romania, Russian Federation, Rwanda, Saudi Arabia, Senegal, Serbia, Sierra Leone, Singapore, Slovak Republic, Slovenia, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Tajikistan, Tanzania, Thailand, Togo, Tunisia, Uganda, Ukraine, United Arab Emirates, United Kingdom, United States, Uruguay, Uzbekistan, Venezuela RB, Viet Nam, Yemen Rep., Zambia, Zimbabwe.

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Artificial Intelligence between Benefits and Speculative Challenges

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Abstract

We observe daily how digital technologies enter our lives, influence us, and transform us, becoming crucial to address the problems and constraints arising from vulnerabilities and inequities to adapt to the rapid pace of change in the plan digitization. The role of transformative AI is obvious, perhaps causing a revolution in technology for the administration public, business, and citizens, maybe bringing uncertainty amplified by the tensions geopolitics.

In the study undertaken, we highlighted the need to use AI, the effects ITS on growth economic aspects of everyday life: cars, phones, watches, smart homes, the negative implications it can have on companies and individuals both if it is not managed properly, but and skepticism people dreamed of the impact technology Digital on their lives. We must have a vision common and coherent, targeting the digital age towards which we are rapidly moving to learn, work, socialize, interact, and access services such as health, culture, various organizations, and governments.

Key words: artificial intelligence, medical software, Blockchain concept, virtual reality

J.E.L. classification: O33, O39

1. Introduction

To questions like "What is artificial intelligence?", "What are the risks of using AI?", and "How will AI influence the future of humanity?" various answers were given that failed to remove the distrust of the skeptics in such a technology but also the optimism of the visionaries.

There are many open questions about human moral responsibilities, and how responsibilities and obligations should be distributed among AI engineers, manufacturers, users, and other stakeholders, but the idea of bringing humans and AI together and placing them in the category of responsible entities. is quite controversial.

It is noted that the AI that is already in use, along with the AI that is being developed, but also an artificial intelligence that is speculated to be used in the future. To be sure, the term AI takes on different connotations because it is a technique in a real or imagined context, presenting characteristics that visionaries describe as intelligent, and the mass, having difficulty in really assessing the impact of AI development, identifying benefits and risks.

Although AI has become an integral part of everyday life quite quickly, we can say with certainty that this will represent a real revolution in our future "Fourth Industrial Revolution", although the pace and direction of technological progress in artificial intelligence are difficult to predict and short-term and quite difficult to separate marketing from implementation. Companies in various sectors of activity are concerned about the high productivity that must be connected with the implementation of cutting-edge technologies and express concern that the excessive use of AI can divert investment into other innovations that play an important role in business. You must note that AI includes a wide range of applications and technologies that do not lead me to believe that they have more than apparent intelligence that has the quality open to interpretation.

Artificial intelligence is considered the defining technology of the last decade and certainly of the next decades, starting from the fact that AI is those systems of intelligent behavior that can analyze the environment, and make decisions, with a certain degree of autonomy, to achieve the specified objectives, with no restrictions on the methods to obtain intelligence. With artificial

intelligence systems set for increasingly autonomous action and widespread use, issues related to AI safety, transparency, and accountability, including decision-making, discrimination, job loss, and malicious use of AI, are becoming important on the AI policy agenda.

2. Theoretical background

To the question "What can artificial intelligence teach us about the mind?", Levesque (2017) explains to us as clearly as possible that "old-fashioned artificial intelligence", which is based on the understanding of commonsense intelligence, can handle situations that depart from previous patterns, just like in real life. Schema Winograd by Levesque and colleagues points out that "If our goal is to understand intelligent behavior, we had better understand the difference between doing it and faking it."

As artificial intelligence becomes dynamic and ubiquitous it raises questions about the future of humanity, which has become a historical challenge. According to the authors, artificial intelligence can solve crises such as climate change, geopolitical conflicts, and income inequality, and revolutionize fields such as medicine or architecture. But there is also the flip side, Artificial Intelligence can generate unimaginable challenges capable of changing our judgment and even stimulating a new phase of human evolution. (Kissinger, Schmidt and Mundie, 2024)

AI is a revered and misunderstood technology, it has uniformly failed and deep learning should be seen as a foundation for what is to come, as Eugene Charnaik argues in his work. He argues that the development of AI may lead to the end of jobs, creativity, and the extinction of humans as a species. (Charnaik, 2024)

Another AI challenge is the aesthetics of computer art, with types of computer art being identified. The study of creativity in AI explores the links between computer art and the traditionalist perspective, given that the use of artificial intelligence compromises the aesthetic credentials of computer art, and writing a computer program cannot be equivalent to painting with a brush. (Boden and Edmonds, 2019)

The decisions we make about AI will shape the future of humanity, so there needs to be a coherent policy aimed at overseeing AI's layered data, and how it got to the problematic situation of how dangerous AI can become if not controlled. (Marcus, 2024)

Billionaire Elon Musk believes that artificial intelligence will surpass human intelligence by developing at a rapid pace, which is difficult to understand because the real problems are not properly understood. He claims: "My assessment of the reason for that artificial intelligence is overlooked by very smart people who do not believe that a computer can ever be as intelligent as it is. And this, which is evidence of excessive pride, is false. We're heading towards a situation where AI is much 'smarter' than humans and things get unstable or weird."

Unfortunately, billionaire Elon Musk's vision is as real as it gets, humanity may face a catastrophic future if the use of AI is not regulated because there will be individuals who could use AI to take control of humanity in a world dictatorship, or they would be a risk of AI technology being used by terrorists. In addition to all this, we have to worry about safety, discrimination, and privacy protection because voice cloning and reality distortion tools, deepfake, are used for disinformation and phishing, individuals can isolate themselves socially, and underestimate themselves by confusing the capabilities of AI systems with human ones, and the moment the AI becomes conscious, moral dilemmas arise related to its rights and the risk of being treated inappropriately.

We must not overlook the fact that AI has great potential to solve the grand challenges facing humanity in key areas such as medicine, the environment, and natural resources. The power we give to AI must become all the more important as AI uses it in ways we can rely on, prompting a rethinking of the entire paradigm.

3. Research methodology

The adoption of AI systems has a strong potential to benefit society, generate economic growth, and strengthen EU innovation and global competitiveness, but in some cases, the specific characteristics of AI systems may create safety risks, including the physical safety of users, and fundamental rights but also systemic risks. This situation generates uncertainty, determining a slower adoption of AI technologies, by public authorities, businesses, and citizens, as a result of the lack of trust, that is why a classification of risks was made based on the expected role of the AI system, which depends on the function performed by the AI system, the purpose and the specific ways in which that system is used.

The high degree of risk of AI systems occurs in two situations: the first situation is when the AI system is integrated as a safety component in products regulated by legislation or represents another product, for example, medical software, and the decisions that a patient's medication can be administered will only be made on data obtained by AI. The second situation occurs when the AI system is used in areas with a higher degree of risk, such as education, employment, law enforcement, or migration. If we take the Facebook-Cambridge Analytica affair as an example, it has been found that both individual firms and large firms cannot manage the ethical and social threats generated by AI technologies as long as there are no clear policies aimed at this controversial area.

The use of AI required the development of a regulation to be used by all EU member states, therefore, in August 2024, the regulation called "Artificial Intelligence Law" was adopted, which provides guarantees in terms of protecting the fundamental rights of citizens but creating an environment conducive to investment and innovation. This law envisages a prospective definition of AI that takes into account the safety of products but also the risks that may arise. While AI has the potential to bring significant positive change in many areas, its risks should not be underestimated.

Unacceptable risk violates the fundamental rights of individuals by manipulating human behavior, invading personal privacy when facial recognition technologies are used to track people's movement without their consent, use of remote biometric systems for law enforcement in public places, using of images facial expressions extracted from the Internet for the creation or expansion of databases, the creation of fake news or the manipulation of public opinion through recruitment algorithms that favor certain persons in the disadvantage of others, algorithms being able to reproduce and amplify social and cultural stereotypes, if they are not monitored correctly, the exploitation of people's vulnerabilities, individual police activities that use predictive analysis to create profiles of some people.

High risk_{AI} systems that negatively impact the safety of citizens are considered to have a high degree of risk, they relate to the safety components of products regulated by the Union's sectoral legislation, and the risk may arise when they will be subject to a conformity assessment by a third party under sectoral legislation, in other words, AI systems can predict whether a person should receive a certain medical treatment, get a certain job or a loan to buy an apartment.

The specific risk aims at the lack of transparency and explainability because the complexity of AI systems cannot be understood by humans making it difficult to explain why AI resorts to certain decisions worrying situations regarding transparency and accountability. If AI becomes too advanced it will not be possible to understand how it works and may cause risks not controlled even by those who created it., The AI Regulation introduces specific transparency requirements for certain AI systems where there is a clear risk of manipulation such as using chatbots or *deepfakes*, users should be aware that they are not interacting with a person.

Risk_{minimally}, is related to the daily use of AI systems affecting individual or small groups of persons and are not so serious compared to systemic risks, but can significantly influence the operation of a certain system or domain, such as technical errors caused by the failure of an algorithm, incorrect processing of data or loss of data due to software errors, algorithmic discrimination, AI may discriminate based on race, gender or other characteristics, job cuts by replacing jobs traditional, causing the loss of jobs for the less qualified. System providers may choose on their initiative to apply Trusted AI requirements and adhere to voluntary codes of conduct.

Systemic risks, they are much more complex, they can affect society, the economy at large, they come from the large-scale use of AI in critical infrastructures and in decisions that influence millions or billions of people, examples of this are: the impact on the labor market by creating inequalities economic and social ones for people who cannot find another job or do not have access to continuing education; concentration of economic power for companies using advanced AI technologies creating monopolies or oligopolies with negative effects on competition and innovation; effects on mental and social health by replacing human interactions with AI interactions that affect individuals' ability to have emotional connections and a healthy balance in social life; the risk of global control and insufficient regulations can cause major global risks such as: autonomous weapons or critical decisions made by AI without human intervention, powerful models that can cause serious accidents or could be misused for large-scale cyberattacks.

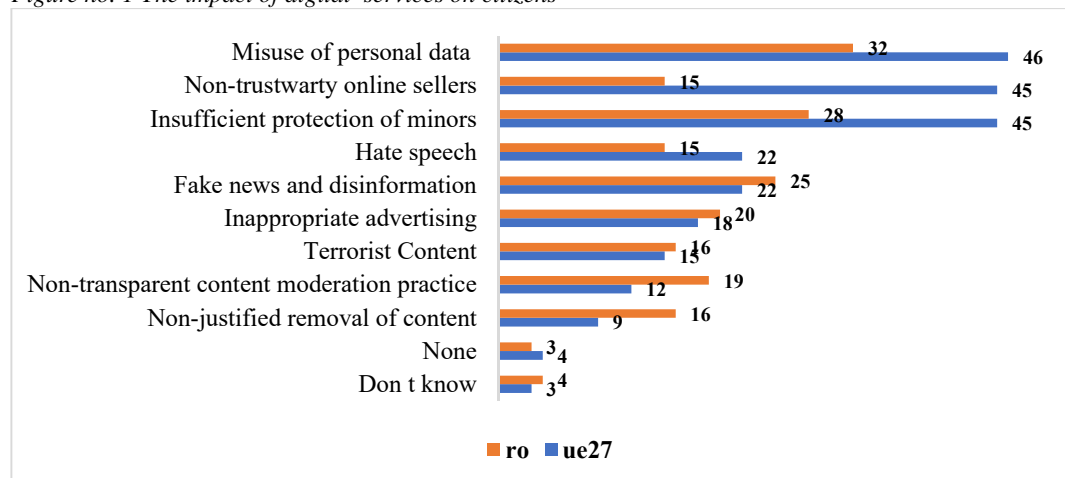
To prevent or minimize these risks, it is essential to adopt clear ethical and technical regulations, invest in research and education, to have a close collaboration between governments, international organizations, and the private sector to develop standards and policies that protect society the systemic risks of AI while ensuring its benefits.

4. Findings

The Eurobarometer surveys undertaken at European level focus on the perception of row EU citizens, what involves the role of digital technology, and the impact expected in the future close.

In what follows, we have analyzed how important is for citizens digital policy, whether digitization services are publicly and private to facilitate the daily use of digital technologies, awareness that these offline rights must be respected in the online environment, whether their rights are protected or not in the online environment.

Figure no. 1 The impact of digital services on citizens

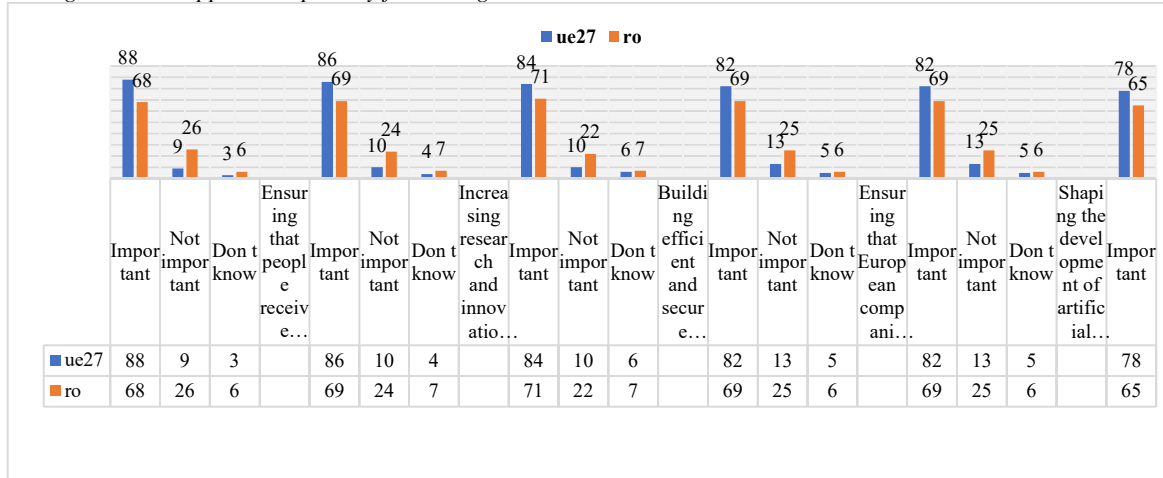


Source: Own processing using data (Eurobarometer)

As it can be noticed from the questions the respondents answered, related to the fact that there is a misuse of personal data (32%), insufficient online seller protection (15%), a deficit protection of minors (28%), there is a big discrepancy between answers provided by Romanian citizens and EU citizens, whose distrust in AI technology is much high (standing between 46% and 45% respectively). To questions about fake news and misinformation (25%), inappropriate advertising (20%), and terrorist content (16%) answers from Romanian respondents were quite close to those of EU respondents, with a variation content between 1% and 3%.

Another notable question for supporting AI technology was related to the importance that the Romanian public authorities grant of these technologies, in particular, the improvement use of daily digital technologies, accessibility of citizens to high-speed internet and data processing facilities, construction of some infrastructure safe and efficient, support for education development skills to use of digital services, insurance to the fact that digital technology use transitions ecological.

Figure no. 2 Support and priority for the digital decade

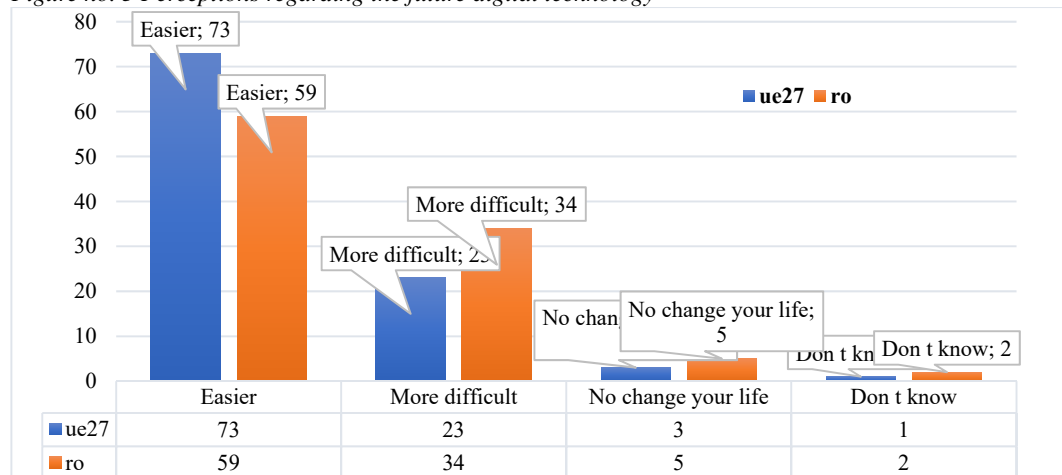


Source: Own processing using data (Eurobarometer)

In this case, the answers of Romanian citizens differ substantially from the answers of EU citizens, skepticism of Romanians being evident in all fields of activity, especially when it's about support granted by the national authorities for the technological transformation in their lives (68%) compared to the trust EU citizens have in the support granted by the authorities of their countries (88%). The same situation we encounter in event growth research and innovations for a have digital technology that may be safe and strong, in which the Romanian respondents have a low confidence (69%) compared to those Europeans (86%). To the question of digital technology used to SED transitions ecology, the answers were relatively close in percentage, respectively 65% at Romanian citizens and 78% at EU citizens.

To the question of digitization services publicly and daily privates fail saddle bring change positive, making their lives may light, or negative changes, through shortness learning dailies, the answers of Romanian citizens are down, relatively close (59%) versus (73%) responses from EU citizens.

Figure no. 3 Perceptions regarding the future digital technology



Source: Own processing using data (Eurobarometer)

Until 2030, Romania proposes that the environment of national business be mature, competitive, digitized, and innovative, supported by an administrative framework and a quality infrastructure comparable to those of the majority EU members.

5. Conclusions

The use of artificial intelligence has generated many conclusions and points of view, both positive and negative, from people, depending on the context in which it is applied and the effects it can have on society.

In general, people are aware that AI has tremendous potential, but at the same time, they are concerned about the risks it can bring if this technology is not properly regulated and implemented. That is why there are increasing concerns for the development of ethical regulations and collaboration between governments, industry, and civil society for a responsible and fair use of artificial intelligence. Romania's target is to reach the number of 400,000 specialists in the digital field by the end of 2030, which would represent 4% of the workforce, but, taking into account Romania's current performance and dynamics, efforts to improve qualification and retraining workers, to stimulate lifelong learning seem insufficient. Taking into account the fact that in 2023 there was a reduced percentage of 27.7% of the population who had basic digital skills, compared to the EU which had a percentage of 55.6%. The existence large differences between age groups, only 6.2% of the population aged over 65 had minimum digital skills and 47.2% of the population aged 16-24 had basic digital skills. The digitization of public services is not good either, but efforts are being made for radical improvements in terms of transparency, simplification, and quality in the coming years.

We can conclude that a controlled AI can make many areas of activity more efficient, and it can generate economic growth by improving operational efficiency, and decision-making processes that increase work productivity, it can benefit the health system because AI can help quickly identify diseases and the creation of more precise treatments with a positive impact in the medical field and in the case of pandemics, AI can help analyze data in real-time, contributing to quick and informed decisions, it can generate major changes in the education system, being essential for people to learn new skills to cope with the changes brought by AI the discovery of new technologies and innovative solutions, thus contributing to progress in various fields such as transport (autonomous cars), manufacturing (smart factories), and even space exploration, can strengthen EU innovation and competitiveness at the level worldwide.

The consequences and challenges of AI cross borders, therefore international cooperation become very important and the Office for AI is responsible for the international involvement of the European Union in the field of AI.

In conclusion, a successful digital decade will not be possible without the involvement of citizens and authorities to help them navigate the effects of digital transformation in their lives, and in the future, AI must bring substantial improvements to health, productivity, mobility, and decision-making, as well as the indirect benefit related to efficiency gains and gadgets that provide novelty or entertainment. No one can predict the future, multiple AI development paths need to be carefully examined to be able to shape the development of AI and to prepare for the opportunities and challenges it may generate.

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Analysis of Gender Differences in Participation in Continuing Vocational Training: An Organizational Perspective

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Abstract

This study examines gender disparities in continuing vocational training (CVT) from an organizational perspective. By analyzing data from different sized companies, the research identifies significant differences in access to CVT between men and women, highlighting systemic challenges and barriers. Quantitative analysis reveals a consistent inverse proportionality of participation rates, with women often being more involved in CVT programs, particularly in smaller organizations, where their participation rates are significantly higher than men's. These findings suggest that organizational policies, cultural factors, and structural barriers influence access to training opportunities. The research highlights the importance of developing inclusive strategies and flexible training programs that address the specific needs of both sexes. It also emphasizes the role of equitable resource allocation and policy adjustments in promoting balanced professional development and improving organizational performance. By providing actionable insights, this study contributes to the discourse on gender equality in vocational training and its implications for workforce development.

Key words: gender equality, continuing vocational training, organizational perspective, strategies

J.E.L. classification: J16, J21, J24

1. Introduction

Participation in continuing vocational training is a key aspect of an organization's human capital development, having a direct impact on the competitiveness and adaptability of individuals in a changing socio-economic environment (Kabeer N., 2021). In this context, gender differences can significantly influence access, motivation and opportunities to participate in such programs. Studies on the role of gender in continuing education emphasize the complexity of interactions between individual, social and institutional factors, highlighting existing challenges and inequalities (Kraft et al, 2020).

This paper aims to analyze in detail the gender gaps in participation in continuing education, focusing on identifying specific determinants, barriers and outcomes, quantifying these gaps, assessing the statistical significance and identifying the practical relevance of the findings. In addition, the study aims to highlight the extent to which public policies and institutional initiatives contribute to reducing these differences, thereby promoting equal opportunities.

By investigating the current context and emerging trends, this paper makes an important contribution to our understanding of the relationship between gender and access to continuing vocational training, supporting the development of more inclusive and effective strategies.

2. Theoretical background

Continuing Vocational Training (CVT) is a fundamental component of lifelong learning, aiming to develop and update individuals' vocational competences to meet the demands of a changing economic and technological environment. It is a form of organized learning, taking place after the

completion of formal education, which contributes to maintaining and improving performance in the workplace, adapting to new technologies and organizational changes, and to career development.

CVT is defined as the set of structured educational activities aimed at improving professional knowledge, skills and attitudes (Goldin, 2021). In the literature, CVT is distinguished by three key characteristics: 1. Flexibility: programs are tailored to the specific needs of participants and the labor market; 2. Relevance: content is closely linked to the practical requirements of the workplace; 3. Continuity: it is an ongoing process necessary to respond to rapid changes in the professional environment (Tabassum, 2021).

Continuing vocational training (CVT) benefits from a rich theoretical grounding, being influenced by multiple disciplines such as economics, sociology, psychology and pedagogy (Chuang, 2021). This theoretical framework provides diverse perspectives on how individuals learn, adapt and develop their competencies in the professional environment. In this section, we review the main theories underpinning CVT, emphasizing their implications for practice.

The human capital theory proposed by Gary Becker (1964) shows that continuing education and training are investments that bring economic benefits to both individuals and organizations. According to this theory, the skills and knowledge acquired through CVT increase productivity, contributing to increased personal income and organizational profitability. In the context of CVT, this theory justifies the allocation of resources to training programs, highlighting the link between employee skills and the competitive advantage of organizations. According to this theory employers invest in CVT to keep their workforce up-to-date and competitive, and public policies promote CVT to reduce structural unemployment and support job mobility (Levy, 2020).

David Kolb (1984), in experiential learning theory, argues that learning is most effective when individuals can use their previous experiences as a starting point to assimilate new knowledge and skills. In this model, learning is cyclical, involving four essential stages: concrete experience, observation and reflection, abstract conceptualization and active experimentation. In CVT, this theory is central to the design of programs that capitalize on participants' work experiences, tailoring them to their specific needs. Case studies, simulations and practical projects are commonly used methods to facilitate experiential learning.

The constructivist perspective on learning, advocated by authors such as Piaget (1926) and Vygotsky (1978), suggests that learning is an active process in which individuals construct meaning through interaction with the environment and collaboration with others. In CVT, this principle is used to develop collaborative programs based on problem solving and knowledge sharing among participants. According to this perspective, vocational training is most effective when active participation is encouraged through group activities and brainstorming. Mentoring and communities of practice are means through which learning becomes contextualized and relevant to professional needs.

In addition to human capital, CVT also builds on the concept of social capital, which emphasizes the role of networks of relationships in facilitating access to information and learning opportunities. Granovetter (1973) emphasizes the importance of 'weak ties' - looser but diversified relationships - in providing access to new information and useful resources. Within CVT, this theory suggests that training should also include aspects of networking to give participants the opportunity to expand their contacts and access to professional resources.

Self-determination theory, developed by Deci and Ryan (1985), explores how motivation influences learning. It distinguishes between intrinsic motivation (driven by the personal desire to learn) and extrinsic motivation (driven by external rewards, such as promotions or salary increases). CVT programs that focus on personal and professional relevance tend to be more effective in cultivating strong intrinsic motivation. According to this perspective, it is possible to tailor training programs to match participants' individual and professional goals and to create an environment that supports autonomy, competence and positive interpersonal relationships.

Theoretical perspectives on change (Lewin, 1947; Kotter, 1996) highlight how CVT facilitates organizational transformations. By updating employees' skills, CVT supports the implementation of new strategies and technologies. In addition, it helps to reduce resistance to change by increasing confidence in adaptability.

Recent studies provide valuable insights into the factors influencing participation in CVT, particularly in the context of the social, economic and environmental changes of recent years. In a landscape marked by pandemics, urbanization and the transition towards sustainable development, they highlight the role of public policies, organizational strategies and educational initiatives.

The COVID-19 pandemic has generated a reassessment of public intervention measures and their impact on different social groups. The studies by Stan, Rus and Tasente (2020) and Nemirschi and Vancea (2020) explore young people's perceptions and industrial adaptations, highlighting the need for flexible policies that support inclusion and equal access to resources. These findings complement the analysis of unbalanced access to training, especially in small and medium-sized organizations.

At the same time, urbanization and sustainable rural development put pressure on HR strategies and organizational priorities. Stan (2022) investigates the impact of the pandemic crisis on employment, and Stan and Cortel (2022) examine the role of planning frameworks in local communities, concluding that well-structured policies can help reduce inequalities and increase equitable opportunities.

Sustainability perspectives play a central role in developing job skills and promoting gender equality. Grigorescu et al. (2023) introduce the concept of a green skills matrix for civil servants, while Munteanu, Ionescu-Feleagă and Ionescu (2024) address financial strategies for the circular economy. These studies suggest that integrating sustainable competences into training curricula can support diversity and inclusion while addressing the challenges of organizational change.

On the other hand, CVET is increasingly benefiting from innovative tools such as gamification. The study by Căpățină et al. (2024) demonstrates the effectiveness of these tools in improving employee retention and performance, highlighting their potential for reducing gender differences in access to learning opportunities.

Economic and social factors also play a key role. Brașoveanu's (2023) analysis of the environmental impact of regional development and Bătrâncea et al.'s (2023) studies on the determinants of economic growth highlight the complex interdependencies between economic development, public policies and organizational initiatives.

Finally, perspectives on gender and religion provide a relevant cultural and sociological framework. Stan, Vancea, and Zaharia's (2023) study (Stan, Vancea, and Zaharia, 2023) addresses the link between women, religion, and conflict, complementing the understanding of the role of cultural values and norms in participation in vocational training. These can significantly influence organizational policies and human resource strategies.

In conclusion, the literature supports the idea that balanced participation in vocational training is conditioned by a combination of economic, social, cultural and organizational factors. These studies provide a solid framework for further analysis of gender differences and for the formulation of more inclusive and effective policies within organizations.

The theoretical framework of continuing vocational training is diverse and complex, bringing together complementary perspectives from multiple disciplines. Applying these theories in practice enables the design of effective and relevant programs that respond to individual needs as well as to organizational and economic requirements. CVT thus becomes an essential tool for personal, professional and societal development.

CVT plays an important role in bridging the gap between existing skills and those required by employers. Major benefits include increased competitiveness in the labor market, improved job satisfaction and increased adaptability to organizational change (Dwivedi et al, 2024). At the same time, CVT contributes to reducing structural unemployment and creating a more resilient workforce. While the benefits are numerous, CVT faces challenges such as high costs, unequal access to quality programs, limited time allocated by participants, and lack of clear supportive policies. There is also a growing need to tailor programs to meet the diversity of professional and individual needs.

In conclusion, continuing vocational training is a central pillar of professional and economic development, integrating theoretical and applied perspectives to support the continuous adaptation of individuals and organizations to global dynamics. Studying and improving this process is essential for a knowledge and innovation-based economy.

3. Research methodology

The study uses a quantitative research design, based on paired-sample comparisons, to analyze the participation of men and women in the same organizations. This approach allows accurate measurement of gender differences and provides a sound basis for statistical interpretation of the results.

The data used in this study include paired observations on CVT participation rates for men and women, categorized by small, medium and large companies according to the number of employees. Information was collected from organizational sources using standardized methods for reporting CVT participation. Data were collected from the Eurostat database. Each dataset was structured in such a way as to allow analysis of gender differences within the same organization.

For data analysis, the following statistical methods were applied: a. Paired Samples t-Test to assess the average differences between male and female participation in each company category; b. Effect sizes (Cohen's d and Hedges' correction) to quantify the magnitude of the gender differences and interpret them in terms of their practical relevance; c. Confidence intervals (95%) to establish the limits within which these differences can be generalized with a high degree of certainty; d. Assessment of statistical significance ($p < 0.05$) to validate the results obtained.

The analyzed population consists of employees participating in the CVT, distributed in three categories: small companies (10-49 employees), medium-sized companies (50-249 employees) and large companies (more than 250 employees). The data reflect individual participation in training programs, segregated by gender, for each organization analyzed.

4. Findings

Table 1 presents the correlations between male (M) and female (F) participation in continuing vocational training (CVT) for various categories of companies categorized by company size. The perfectly negative correlation (-1.000) between the two groups, with an extremely high level of significance ($p < .001$ for one-tailed and two-tailed tests), indicates an absolute inverse proportional absolute relationship. In other words, an increase in participation of one gender is directly associated with a decrease in participation of the other, regardless of company size.

The very low p-value indicates that this relationship is not random but reflects a systematic pattern. It suggests a strict segmentation of access to continuing education and training by gender, either through organizational policies, cultural factors or internal practices.

From a business management perspective, this result highlights a significant imbalance between men and women in terms of access to CVT programs. In small, medium and large companies, the phenomenon is consistent, indicating a systemic problem rather than one specific to a particular type of organization. This situation may have several causes: gender stereotypes, which may lead to men's inclination towards technical programs, family responsibilities which affect women more, or even a lack of flexibility in the organization of training to meet the needs of both groups.

Table no. 1 Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Total B	37.4082	110	14.68045	1.39973
	Total F	62.5918	110	14.68045	1.39973
Pair 2	Companies 10-49 empl. M	24.7627	110	14.25831	1.35948
	Companies 10-49 empl. F	75.2373	110	14.25831	1.35948
Pair 3	Companies 50-249 empl. M	34.0682	110	15.62077	1.48938
	Companies 50-249 empl. F	65.9318	110	15.62077	1.48938
Pair 4	Companies over 250 empl B	49.6964	110	15.15344	1.44482
	Companies over 250 empl F	50.3036	110	15.15344	1.44482

Source: authors' own processing by SPSS

These data, presented in Table 2, suggest that managers need to investigate the barriers that lead to this imbalance and adjust policies to promote equitable access to training. Training programs should be rethought to include both men and women in a balanced way. It is also essential to develop flexible strategies to enable both genders to access vocational training, considering their different needs and constraints.

Another important issue is the impact of this imbalance on organizational performance. Limited access to training for one gender can affect the diversity of skills and team effectiveness. Therefore, balancing access to CVT not only responds to equal opportunities requirements, but also contributes to the development of better trained and more diverse human capital.

In conclusion, the perfectly negative correlation between male and female participation in CVT highlights a systemic problem that requires strategic interventions at the organizational level. Managers need to focus their efforts on removing barriers that limit access to training and on creating an inclusive environment capable of supporting balanced skills development for both genders.

The results presented in Table 2, Paired Samples Test, analyze the average differences between male (M) and female (F) participation in continuing vocational training (CVT) by company size categories. Interpretation of the results reveals significant insights into how access to CVT is influenced by gender and organization size.

Table no. 2 Paired Samples Test

		Paired Differences					t	df	Significance	
		Mean	STD	Std. Error Mean	95% Confidence Interval of the Difference				One-Sided p	Two-Sided p
					Lower	Upper				
Pair 1	Total_M - Total_F	-25.18	29.36	2.79	-30.73	-19.63	-8.99	109	<.001	<.001
Pair 2	10-49emplM 10-49empl F	-50.47	28.51	2.71	-55.86	-45.08	-18.56	109	<.001	<.001
Pair 3	50-249emplM 50-249emplF	-31.86	31.24	2.97	-37.76	-25.95	-10.69	109	<.001	<.001
Pair 4	over250emplM over250emplF	-.6072	30.30	2.88	-6.33	5.11	-.210	109	.417	.834

Source: authors' own processing by SPSS

For the whole population analyzed (Total_M - Total_F), the mean difference is -25.18, indicating that women participate significantly more than men in CVT, with a statistically significant difference ($p < .001$). The 95% confidence interval (-30.73 to -19.64) shows that this difference is robust and consistent, and the negative t-score (-8.996) confirms this trend. This result suggests that women have a much more pronounced presence in continuing professional development programs, which may reflect either a greater openness to professional development or a priority given to it by organizations.

For small companies (10-49 employees), the average difference between male and female participation is higher (-50.47), indicating an even more pronounced bias in favor of women. The t-value of -18.564, with an extremely high statistical significance ($p < .001$), confirms this imbalance. The confidence interval (-55.86 to -45.09) shows that the mean difference is consistent and significant. This result may reflect a greater focus on women's training in small companies, which may be related to their specific roles in the organizations or a compensation strategy for possible career barriers.

For medium sized companies (50-249 employees), the mean difference is -31.86, with a confidence interval of -37.77 to -25.96 and high significance ($p < .001$). This difference, although smaller than for small companies, is still substantial, indicating a continuation of the trend of higher female participation in training. This result may signal that as the size of the organization increases, women continue to benefit from greater involvement in CVT, possibly because of more structured and inclusive policies.

For large companies (more than 250 employees), the average difference between men and women is almost non-existent (-0.607) and statistically insignificant ($p = .417$ for one-tailed test and $p = .834$ for two-tailed test). The confidence interval (-6.33 to 5.12) includes the value zero, indicating that there is no real difference between men's and women's participation in CVT in this type of organizations. This result can be explained by more well-defined equal opportunity processes in larger companies, which have more consistent resources to provide equal access to both genders.

From a business management perspective, these results highlight a clear need to adjust training strategies to ensure gender equity. In small and medium sized companies, managers could continue to encourage women's involvement but must be careful not to neglect the development of men's skills. In large companies, where participation is more balanced, it is important to maintain this neutrality through transparent and fair policies. Overall, the evidence suggests that tailored approaches that consider the specificities of each company size are essential to maximize the impact of training programs.

Table 3 presents the effect sizes for the pairwise differences between male (M) and female (F) participation in continuing vocational training (CVT), using Cohen's d and Hedges' correction indicators to quantify the magnitude of the differences between the two groups by company size.

Table no. 3 Paired Samples Effect Sizes

			Standardizer ^a	Point Estimate	95% Confidence Interval	
					Lower	Upper
Pair 1	Total_M - Total_F	Cohen's d	29.36090	-.858	-1.075	-.638
		Hedges' correction	29.56487	-.852	-1.068	-.633
Pair 2	Comp 10-49 empl M Comp 10-49 empl F	Cohen's d	28.51662	-1.770	-2.068	-1.468
		Hedges' correction	28.71473	-1.758	-2.054	-1.458
Pair 3	Comp 50-249 empl M Comp 50-249 empl F	Cohen's d	31.24155	-1.020	-1.249	-.788
		Hedges' correction	31.45859	-1.013	-1.240	-.782
Pair 4	Comp over 250 empl M Comp over 250 empl F	Cohen's d	30.30688	-.020	-.207	.167
		Hedges' correction	30.51743	-.020	-.205	.166
a. The denominator used in estimating the effect sizes. Cohen's d uses the sample standard deviation of the mean difference. Hedges' correction uses the sample standard deviation of the mean difference, plus a correction factor.						

Source: authors' own processing by SPSS

Cohen's d and Hedges' correction measure the effect size, i.e. the size of the standardized difference between the two groups. Negative values indicate that women (F) participate more than men (B), and the confidence intervals (95%) provide the limits within which these effects lie with a high degree of certainty.

Pair 1: Total_M - Total_F

The overall difference between men and women at the total level has a Cohen's d value of -0.858, with a confidence interval between -1.075 and -0.638. This indicates a moderate to large effect in favor of women, according to the standard Cohen's interpretation (0.2 = small, 0.5 = moderate, 0.8 = large). The result is confirmed by the Hedges' correction (-0.852), which slightly adjusts the effect size for small to medium-sized samples. This result reflects the fact that women, on average, have a higher participation in CVT than men, which may suggest a greater openness or involvement of women in professional development.

Pair 2: Companies with 10-49 employees

For small companies (10-49 employees), the difference is the largest, with Cohen's d of -1.770 and a confidence interval between -2.068 and -1.468, indicating a very large effect in favor of women. Hedges' correction (-1.758) confirms this result. The significant difference shows that women in small companies participate much more frequently than men in CVT. This can be explained by the fact that these companies, which often operate with limited resources, prioritize the development of employees who can have a greater impact on overall performance, and women may be perceived as more receptive to these initiatives.

Pair 3: Companies with 50-249 employees

In medium-sized companies, the difference is smaller than in small companies, but still significant, with Cohen's d of -1.020 and a confidence interval between -1.249 and -0.788. This indicates a large effect in favor of women, suggesting that they continue to be more involved than men in CVT. Hedges' correction (-1.013) supports this conclusion. Medium-sized companies, which are often in transition to more formalized structures, may favor women for skill development, given their importance in various organizational roles.

Pair 4: Companies with more than 250 employees

In large companies, the difference between men and women is almost non-existent, with Cohen's d of -0.020 and a confidence interval including zero (-0.207 to 0.167). Hedges' correction produces the same result (-0.020). This indicates that there is no significant effect in terms of gender differences in CVT participation. In large companies, policies and processes are better defined and standardized, which ensures equitable access to continuing training programs for both genders.

In summary, the research results are presented in Table 4.

Table no. 4 Summary of research results

Analyzed aspect	Small companies (10-49 employees)	Medium companies (50-249 employees)	Big companies (over 250 employees)	Implications and Recommendations
Participation Female vs. Male	Greater participation of women (Cohen's $d = -1.770$)	Greater participation of women (Cohen's $d = -1.020$).	Gender-balanced participation (Cohen's $d = 0$).	Inclusive policies needed in small and medium-sized companies to reduce imbalance
Effect size	Very large effect in favor of women	Large effect in favor of women	Non-significant effect	In large companies, neutrality should be maintained through standardized processes.
Possible causes of the imbalances	Limited resources, different perceptions of professional roles	Transitional strategies in favor of women	Equality promoted through clearly defined resources and policies	Creating gender-inclusive programs adapted to organizational specifics
Effect on performance	Significant imbalance; may affect skill diversity	Moderate imbalance; similar risks	Diversity ensured due to balanced participation	Managers should monitor effects on teams and correct discrepancies
Specific recommendations	Investigations to remove barriers to male access	Tailored programs that include both genders equitably	Maintaining balance through transparent and flexible policies	Adopting a strategic perspective to integrate diversity into all organizations

Source: authors' own processing by SPSS

5. Conclusions

The study highlights the need for strategic interventions to ensure gender-balanced access to continuing vocational training (CVT). Training programs should be tailored to the specific needs of the organization, promoting equal participation for both women and men. Large companies can serve as a model of good practice by implementing standardized and transparent policies that encourage gender balance.

The analysis shows significant differences between men and women in terms of participation in CVT, especially in small and medium-sized companies. In these organizations, women participate much more frequently than men, which may indicate either a greater openness of women to vocational training or a priority given to them by employers. In contrast, these differences almost completely disappear in large companies, where well-defined organizational policies ensure equitable access for both genders.

Possible causes of these imbalances include gender stereotypes, family responsibilities and organizational policies that are not sufficiently inclusive in small and medium-sized companies. Managers in these organizations should investigate the causes of the differences and implement measures to guarantee equal access to vocational training for men and women.

Imbalances in CVT participation can have important organizational implications, influencing the diversity of skills and the effectiveness of teams. Therefore, it is essential to adopt more inclusive and personalized human resources policies that consider the needs and characteristics of each type of organization.

The research results, obtained based on Eurostat data, were validated by rigorous statistical methods, such as paired samples test, effect size measurements and statistical significance analysis. These methods confirm the robustness of the conclusions and highlight the importance of adjustments in human resources policies to promote gender equality in vocational training.

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The Role of .ro Domains in Strengthening Digital Identity and Local Branding in Romania: Insights from Registrants Perceptions

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Abstract

This study analyzes both the perceptions and the preferences of Romanian registrants of .ro domain names, a fundamental element of Romania's national digital identity. Through a quantitative approach, with the help of an online survey, we have collected the responses of 50 registrants, users who have registered at least one .ro domain in their lifetime. The study analyzes factors such as ease of registration process, the reasons of choosing .ro domains, preference over other TLD and the general perception of the .ro extension.

The study shows the importance of .ro domain names as a powerful online marketing tool for online branding, regional competitiveness and increasing user's trust while also providing some insight into the decision-making process regarding domain registration. These conclusions contribute to a better understanding of the advantages of ccTLD's, having relevant implications for companies, individuals and digital marketing professionals interested in optimizing strategies on the local online market.

Key words: domains, ccTLD, digital identity, domain registration, ro domains

J.E.L. classification: M31

1. Introduction

As Romania's digital infrastructure evolves, analyzing the factors that determine the preferences for web domains becomes more important for a deeper understanding of the digital ecosystem. As users become "registrants" for a large number of reasons, from personal projects to wide-scale web platforms that are bound to shift the digital ecosystem, it is important to understand the relevance of national, localized ccTLD's such as .ro compared to gTLD's such as .com, .org, .net etc.. These domains have been integrated into the virtual landscape of the country since the 1990s, being administered by the National Institute for Research and Development in Informatics (ICI Bucharest). However, Romanians' perception of the use and significance of ".ro" domains is influenced by various factors, such as financial accessibility, specific legislation and the feeling of belonging to the national digital space. This study analyzes the perception of Romanian registrants on .ro domains, evaluating a number of factors such as the registering process, the reasons behind the registration and also it's comparison to other gTLD's.

2. Theoretical background

Ever since the creation of the internet, web domains proved to, making web browsing more accessible to the everyday user by mapping a readable name to an IP address through the Domain Name System. National top level domains, also known as ccTLD (country-code top-level domains) are attributed to each country or region, based on the ISO 3166-1 standards of the representation of

names of countries and their subdivisions (Mockapetris, 1987). Romania was attributed the .ro domain extension, which is currently managed and maintained by the national registry, RoTLD (RoTLD, 2023). From a marketing point of view, using a ccTLD's offer some specific benefits for regionalized websites, from better localized SEO, user's trust, domain names availability and national branding. More so, national domain extensions are perceived as more trustworthy than generic alternatives such as ".com" because they reflect association with local regulations and standards. (Martins, Anastácio, 2022).

Digital consumer behavior studies show that national domain extensions are often preferred for websites in localized markets, as it signals geographical and cultural belonging (Chaffey, Smith, 2022). However, the choice of a TLD also depends on practical factors such as price, availability of the desired name and perceptions of the extension's professionalism (Kotler, Keller, 2016). As the Romanian digital space grew exponentially, the RoTLD administrators introduced in 2018 an annual maintenance fee. These changes highlighted the need of analyzing perceptions on the cost-benefit ratio, on the competitiveness of the ".ro" extension in relation to international alternatives and on its role in promoting local businesses (Cristea, Mihai, 2020).

More so, in the context of digital globalization, Romanians face the dilemma of choosing between local and international extensions, such as ".com" or ".eu". This decision is often influenced by psychological, economic and cultural factors, which require in-depth analysis. Previous studies suggest that local domains are associated with consumer trust and preference for national businesses (Toma, 2019).

3. Research methodology

In order for us to determine the perception of registrants of .ro domain names, we based our research on a quantitative method, using an online survey as the main tool for data collection. This survey was designed using Google Forms and the target group was represented by consumers who registered at least one domain with the .ro extension (registrants). This criteria was ensured by the first question of the survey, asking the respondent whether they have ever registered a .ro domain name, thus ensuring the relevance of the answers for the research objectives.

The survey was made up of several questions that aimed to collect information about:

1. Ease of the domain registration process - rated on a Likert scale from "Very easy" to "Very difficult".
2. The way the domain was acquired – through a hosting package or purchased separately
3. Number of domains registered in the last three years – to identify behavior patterns.
4. Type of the registrant – individuals, organizations or a combination of both.
5. Registrant preference – whether they chose RoTLD or a different registrar
6. Awareness of domain management – assessing the respondent's knowledge of RoTLD being the only registry of .ro domains
7. The reasons for choosing a .ro domain - including factors such as SEO, branding, price and external suggestions.
8. Preferences between .ro and .com extensions – for Romanian language sites.

The survey was pre-tested on a small group of respondents to check the clarity of the questions and ensure the consistency of the answers. In order to reach as wide and diverse an audience as possible, the survey was distributed randomly via the internet to various related communities such as forums, social media and group chatting servers. The data collection period spanned two weeks, during which the responses of participants who met the minimum eligibility criterion: registration of at least one .ro domain were recorded.

The sampling method was a convenience one, without using a probabilistic selection, that may introduce some limitations related to the generalizability of the results. However, the exclusive inclusion of users who have direct experience with .ro domains ensures the relevance of the collected data. Demographic variables such as age, gender and location were not collected directly, as we considered them irrelevant, with the focus being on domain registration experience and preferences.

The collected data were exported from Google Forms in a tabular format and analyzed using descriptive statistical tools. Interpretation of responses aimed at identifying dominant trends, relationships between variables and determinants of user preferences. The methodology used provides a relevant picture of consumer perceptions and behaviors, given that the data comes directly from active users of .ro domains.

4. Findings

Our study tried to provide a clearer picture of user perceptions and behaviors in relation to the registration of .ro domains. The analysis of the data collected through the questionnaire distributed online revealed the following main conclusions:

Ease of registration process - The majority of respondents (44%) rated the registration process as "very easy", with another 28% rating it as "easy". With a weighted average of 1.96/5 the conclusion of this question suggests that the registering process is generally perceived as accessible and easy by users. The fact that no respondents indicated significant difficulty (scores of 4 or 5) suggests the effectiveness of current registration systems, which provide an easy and intuitive experience. This result also reflects improvements in the digital infrastructure and interfaces used by registrars, eliminating technical barriers or excessive documentation.

Domain purchase method - 76% of respondents stated that they purchased the domain separately, without including it in a hosting package. Only 24% opted to purchase the domain along with a hosting plan, indicating a preference for flexibility in the registration process.

Number of registered domains - 40% of participants registered between 2-5 domains in the past three years, while another 40% said they registered only one domain. Only 16% reported registering 6-9 domains, and a small percentage exceeded the threshold of 10 domains, which reflects moderate behavior in the use of the .ro ccTLD. This trend indicates an increased desire for independence and customization in managing digital resources. Users want to optimize costs and choose solutions tailored to specific needs, which provides an opportunity for hosting providers and registrars to create more flexible and personalized offers.

Type of users - .ro domains are used by a variety of entities, including individuals (40%), organizations (28%) and, in some cases, both (32%). This distribution shows the need of .ro domains for both individual users and legal entities. This highlights the versatility of .ro domains, which serve a wide range of users, from personal websites or blogs to institutional and corporate platforms. For organizations, .ro domains represent a strategic tool for establishing credibility and alignment with the local market.

Preferred registrar - The most used registrar was RoTLD, chosen by 48% of respondents, followed by other registrars such as Romarg, Hostgate, Roleaf.ro, Clausweb and others. This preference reflects high confidence in the national lead registrar. The use of a variety of alternative registrars (such as Clausweb, Hostgate, etc.) highlights a competitive landscape. This competition can stimulate improved services and prices, benefiting end users. However, the preference for RoTLD emphasizes its role as a trusted leader in managing .ro domains.

Domain administration knowledge - Only 64% of the participants knew that all .ro domains are managed by the RoTLD registry, which suggests an average level of awareness regarding the functioning of the domain infrastructure. This knowledge gap suggests the need for increased awareness campaigns and transparency in the domain registration ecosystem. Clearer communication during the registration process could help increase user trust.

Reasons for choosing .ro domains - on this multiple choice question, the most common reason was the Romanian branding of the website (76%), followed by the regional SEO benefits (52%) and the availability of the desired domain name (48%). Factors such as price or legal requirements had little influence.

Table no. 1 Reasons of choosing .ro domains

Reason	Percentage
Romanian branding of the website	76%
Better regional SEO	52%
Domain name availability	48%
Price	12%
Legal requirement	4%

Source: Author's research

The results confirm that .ro domains are not just a technical choice, but also a strategic decision, deeply integrated into digital marketing efforts. Their benefits in improving search engine rankings for local users, combined with their association with local identity, make them essential assets for organizations.

TLD preference - If both the .ro and .com domain names are available, all respondents (100%) stated that they prefer to register the .ro domain for a website in Romanian. This result clearly reflects the preference for the local ccTLD due to its relevance to the national market. These results show the importance of .ro domains as tools for branding, SEO optimization and strengthening the digital identity on the Romanian market. At the same time, they point to the need to increase the level of awareness regarding the role of the RoTLD registry in the management of these domains.

5. Conclusions

The results of this study show just how significant .ro domains are for strengthening the national digital identity and online presence in the context of the Romanian online market. Analyzing user responses reveals some key takeaways that can help both in understanding consumer behavior and improving digital marketing and domain management strategies.

First, the general perception of the registration process is positive, with most respondents finding it easy and accessible. This favorable assessment underlines that the infrastructure and registration procedures are efficient and well adapted to the needs of users.

Second, the clear preference for purchasing domains separately, without including them in hosting packages, reflects a need for greater flexibility and control over digital resources. Also, the diversity of users, from individuals to organizations, underlines the broad relevance of .ro domains in various contexts, whether personal or professional.

An important aspect highlighted by the study is the importance of Romanian branding as the main reason for choosing .ro domains. This preference demonstrates that the national extension is perceived as a symbol of authenticity and belonging to the local market, being particularly valuable for companies operating in Romania. In addition, regional SEO benefits and the availability of the desired domain name are decisive factors in the selection process.

The unanimous preference for .ro domains in the case of Romanian-language websites reinforces the idea that ccTLDs are effective tools to target local audiences and increase user confidence. However, the moderate level of awareness of the RoTLD registry's role in domain management indicates an opportunity to educate users and promote transparency in this area.

In conclusion, .ro domains play a crucial role in the Romanian digital ecosystem, offering significant competitive advantages for users and organizations. This study provides a solid foundation for understanding domain registration preferences and behaviors, with practical implications for digital marketing strategies, registrars, and RoTLD as a national registry. In addition, the results highlight the importance of supporting users through efficient processes, clear information and opportunities for creating a robust and relevant digital identity in the local market.

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A Bibliometric Analysis on the Role of Financial Education as a Challenge in Sustainable Business Development

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Abstract

In recent years the research relies on state-of-art digital methods for reliable and accurate results, for a full assessment of existing studies. This study is based on the bibliometric analysis, a method generally recognized and appreciated in recent years due to the accessibility of bibliometric software and availability scientific databases. The aim of this research is to analyse the existing works in the field of financial education at the European level and in our country by using keywords, graphical methods of comparative assessment made available by digital applications and databases.

The analysis of researches conducted so far leads to the need of searching for new solutions to adapt to the current economic situation. The studies focus on effective analysis to influence educational decision makers, deans and directors of business schools, to really assess the long-term financial viability of business models and to focus on rethinking these models in the future.

Key words: financial education, business performance, bibliometric analysis.

J.E.L. classification: M10

1. Introduction

Organizations face an acute shortage of skilled staff. In the digitization era, many occupations have disappeared from the labour market. The education is an expensive and time-consuming process, but past experience has proven its inestimable value. The technologies are constantly changing, and the aim is to increase the performance based on quantity and quality with low, unconventional costs. The education is a key factor in pursuing these objectives.

In view of these findings, there is a need for systematic studies and analysis to assess the current level of education and target resources to help increase the level of scientific knowledge and practical skills of the population. One of the methods widely applied in current research studies is the bibliometric statistics, a powerful tool used to analyse and assess the latest results obtained by scientists and research institutions. The research focuses on analysing the existing scientific works on financial education by accessing the Scopus database, using keywords as query tools. The study uses data on the number of citations and publication ranking, the number of existing papers in the field of financial education, as well as social, territorial, economic graphical analysis.

The data extracted from the Scopus database were processed using the R software, version 4.4.2, through the Biblioshiny web interface and VOSviewer software.

2. Literature review

In their 2024 Nobel Prize-winning book "Why Nations Fail", authors Daron Acemoglu and James A. Robinson compared two related, but completely different societies, South Korea and North Korea as follows: "Those in the North grow up in poverty, without entrepreneurial initiative, creativity, or adequate education to prepare them for skilled work. [...] Those in the South obtain a good education, and face incentives that encourage them to exert effort and excel in their chosen vocation."

According to the information published on the OECD website, a major hindrance in timely and effective development of the education system in Romania is the lack of a more flexible and less restrictive legislative, regulatory and procedural framework for institutions and individuals that leaves little room for flexible adaptation and real changes.

In 2014, Drule A. M., Popa I. E., Nistor R., and Chis A. published in „Amfiteatrul economic”, a publication of the University Of Economic Studies Bucharest, the first research “*Quality of the teaching Process and its factors of influence from the perspective of future business specialists*”, cited 1042 times between 2020 – 2023 and 864 times in 2024.

In 2020, Horobet A., Vrînceanu G., Hurduzeu G. and Lupu R., from the University of Economics of Bucharest, published in Walter de Gruyter the paper “*Financial Literacy in Romania: A Test of Economics and Business Students*”. The paper assesses Romania’s position as unacceptably low, ranking last in the European Union in terms of financial literacy. An OECD study indicates differences in the level of knowledge according to demographic characteristics, age, students’ education cycle, lifestyle, property ownership and students’ involvement in transactions and contracts on the financial market.

Cornuel E., Thomas S. and Wood E., analyse in the paper “Looking Back and thinking Forward in Global Focus” the evolution of business schools over the past decade in the face of the pandemic at global level. The pandemic has brought technology-enhanced methods and online learning to the forefront of debates about how to design business models and frame the future of schools to align with the range of challenges associated with the managerial midset.

In the paper “College Students’ Distractions from Learning Caused by Multitasking in Online vs. Face-to-Face classes: A Case study at a Public University in Romania” published in 2022, the authors Kamer Ainur Aivaz and Daniel Teodorescu demonstrate an increase in students’ motivation with the introduction of online courses and the use of digital resources in the learning and evaluation process. Technology is an important way to engage young people and introduce interactive, practical working methods.

3. Research methodology

The research is based on the bibliometric analysis of published works, the cooperation of scientists and research institutes in result evaluation and measurement of outcomes in this field.

Bibliometrics has been a research method used since the 19th century and it has been recognized as relevant in quantifying and analysing data.

This research uses databases in the field of financial education, with a focus on the number of existing papers, in which publication they have appeared so far and which are the most used keywords,

The tool used to identify these publications and keywords was the Scopus database, and the query in the field of financial education used the search key *financial + education + business*.

The database was analysed using the thesaurus option in VOSviewer and the Biblioshiny application for Bibliometrics in R Studio. We selected the Scopus database because it is a well known as a trusted database of scientific data for academic studies, it covers a wide range of keywords and it has a high power in analysing the number of citations, search criteria and result summation.

However, we have to accept a margin of error in the analytic capacity, depending on the database used.

For a graphical analysis of the databases, we used the application VOSviewer and Bibliometrix for R Studio, well known for rendering data in clusters, the sinusoidal links and multifactorial analysis..

4. Findings

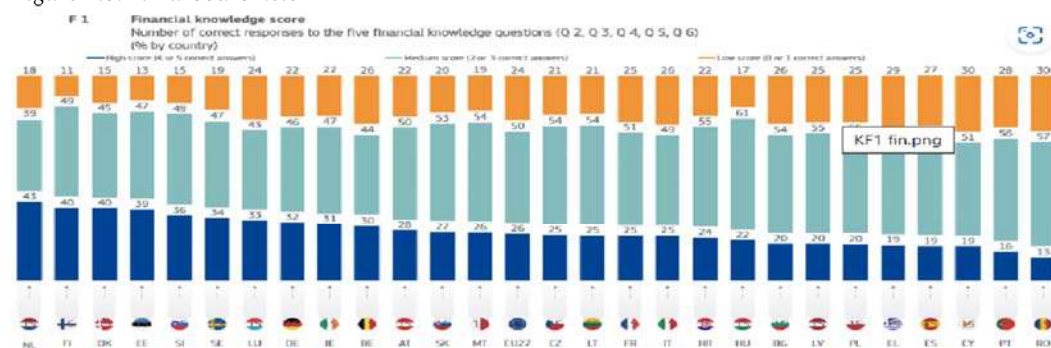
The financial literacy test applied by Ipsos European Public Affairs, administered to a total of 26,139 individuals, out of which 1,063 individuals in Romania, between March 29 and April 5, 2023, placed our country in the last place in the European Union in terms of financial literacy according to the latest Eurobarometer. Figure 1.

The study was commissioned by the European Commission, the Directorate General for Financial Stability, Financial Services and Capital Markets Union, coordinated by the Directorate General for Communication.

Only about a quarter of respondents answered correctly at least four out of five questions on financial literacy. About half of them answered only two or three questions correctly, and another quarter found the questions particularly difficult (either they could not answer any of the questions correctly or they could only answer one out of five). Among the best performing countries are the Netherlands, Denmark, Finland and Estonia, where around four out of then respondents have a high level of financial literacy (43%, 40%, 40% and 39% respectively).

The analysis of the Scopus database by using the search key *financial + education + business** on November 30, 2024, for the time frame between 1999 and 2024 resulted in 270 published papers, and the filter applied for papers in English using the keywords financial management, business education and entrepreneurial education reduced the number of documents to 73.

Figure no. 1. Eurobarometer



Source: (European Commission, 2024)

The economic growth, the industrial and agricultural development is slower in Romania than in other Central European countries, inflation is high and poverty is increasing. In these conditions, it is difficult for education to advance as dramatically as desired in areas such as management and finance, social decentralization or community and parental participation in curricular decisions.

The recommendations for the Romanian Government are to consult with its international partners and to take measures to facilitate and streamline the implementation of external assistance for the development of education based on modern, innovative learning strategies, and interactive, applied teaching practices.

Scopus database was accessed for the time frame 2000 - 2004 by using filters to find and analyse documents. Figure 2 Analysis based on the time frame selected, number of sources, number of documents, annual growth rate, number of authors, number of unique authors, number of international co-authors, number of co-authors per document, number of authors' keywords, number of references, date of publication, average number of citations per document and the list could continue depending on the need for information relevant for the research.

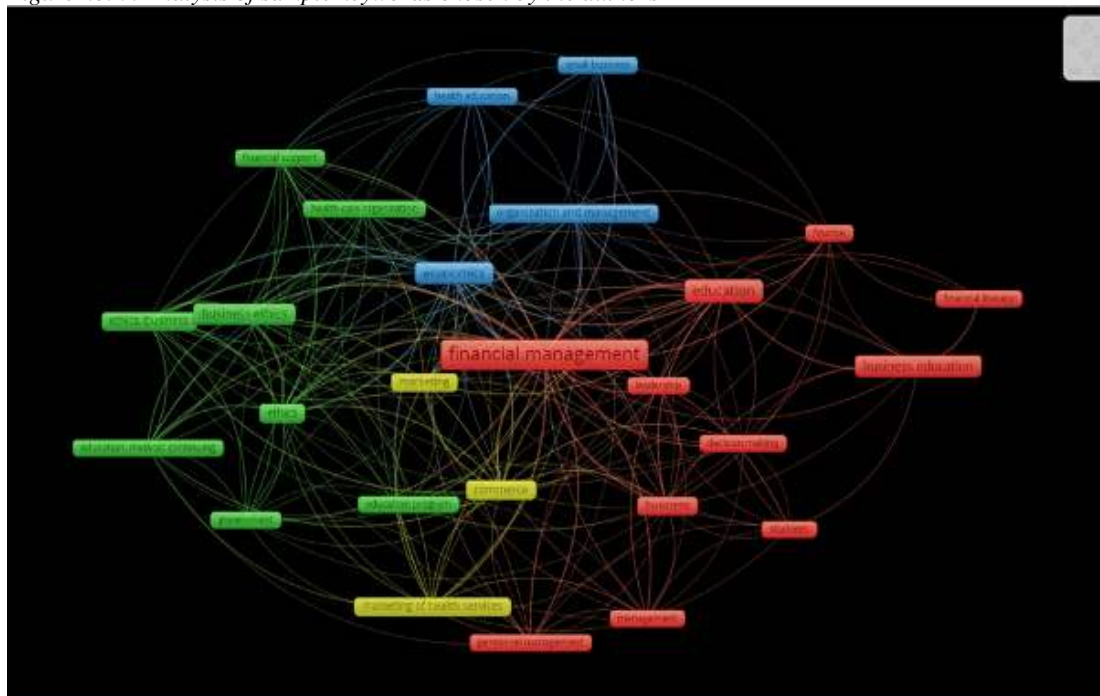
Figure no. 2 Analysis of selected paper sample



Source: Authors' projection based on data extracted from Scopus processed using the Biblioshiny application for Bibliometrix in R Studio, accessed on November 30 2024

The keyword map selected by the authors as relevant for financial education research comprises a total of 239 words, and the use of Thesaurus feature in VOSviewer produced a total of 26 keywords. The conceptual structure of keywords reveals 3 main research themes: financial management, education, and business education. For a relevant research, a structured research model has been generated by using keywords, by interactions between keywords, key phrases to indicate the impact level in the graphic analysis of the financial education matter.

Figure no. 3. Analysis of sample keywords chosen by the authors



Source: Author's projection based on data extracted from Scopus processed with VOSviewer, accessed November 30, 2024

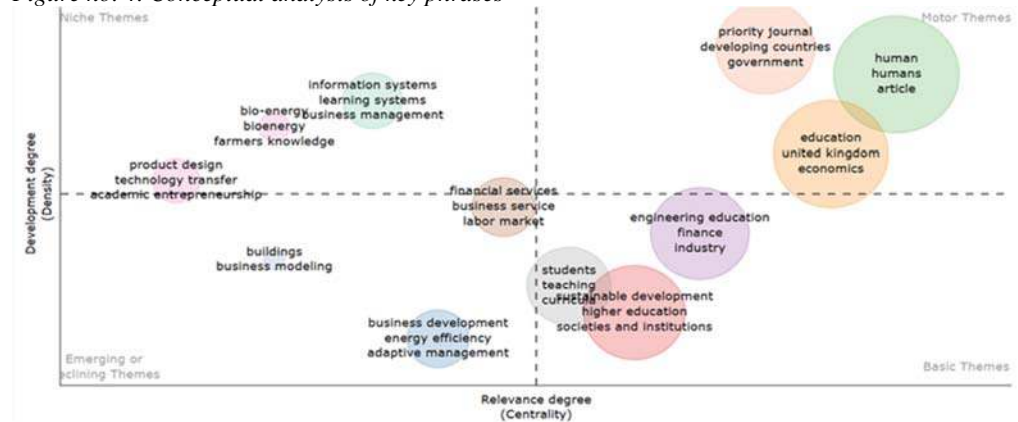
Table no. 1 Most common keywords

Author's keywords	Frequency	Power of links
Financial management.	55.	529.
Economics	19.	245.
Education	24.	194.
Business ethics	14.	181.
Ethics	13.	175.
Organization and management	10.	113.
Marketing	10.	112.
Business	10.	90.
Business education	18.	30.

Source: Author's projection based on data extracted from Scopus, processed buy using VOSviewer

Within the analysed period, 7 papers were found for Romania written between 2014 and 2021. The first of these 7 papers written in 2014 "*Quality of the teaching Process and its factors of influence from the perspective off future business specialists*" by Drule A. M., Popa I.E., Nistor R., Chis A., Babe; Bolyiai University Cluj Napoca, and published in Amfiteatrul Economic, a publication of the University of Economic Studies of Bucharest, was cited 1042 times between 2020 and 2023 and 864 times in 2024. The research was conducted on a sample including more than 1,500 students enrolled in a master's program in financial management. The analysed data have shown that the most influential performance factors are not the seminars and courses, but especially the use of modern teaching techniques and active involvement of students and teachers in learning activities. The study identifies the most relevant factors in ensuring the quality of a Master's program focused on building practical skills and training the experts in the field of domestic and international fund management.

Figure no. 4. Conceptual analysis of key phrases



Source: Author's projection based on data extracted from Scopus processed by using Biblioshiny application for Bibliometrix in R Studio, accessed on November 30, 2024

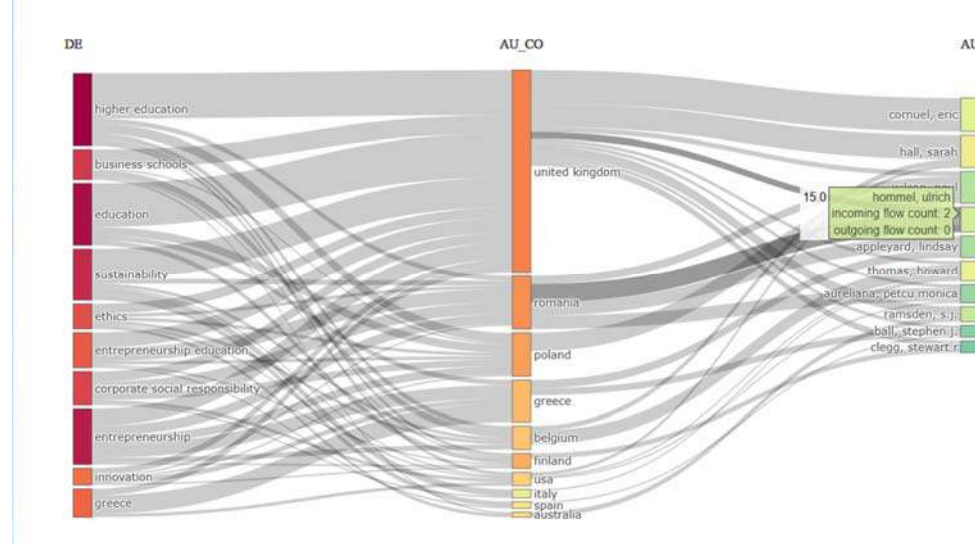
The financial risk analysis presented two unique working models. A conceptual analysis of the development in education level shows relevant progress and signification results in various fields, but the development in financial education seems irrelevant.

For the UK model, capital injection, efficient distribution and cheaper packaging are pathways to profitability and lower risk.

For the Japanese model, diversification of income streams and education reduce the financial risk associated with yield and sales.

The ability to calculate and forecast financial risk could help all developing industries fostering sustainable, successful businesses in their economies

Figure no. 4. Analysis of a sample of keywords chosen by authors from different countries



Source: Author's projection based on data extracted from Scopus processed by using Biblioshiny application for Bibliometrix in R Studio, accessed on November 30, 2024

The database query using the key higher education + business school + sustainability shown as a diagram using the Biblioshiny option in Bibliometrix application for R Studio indicates the level of territorial density of the number of authors and papers written in the field of financial education. The graphic analysis shows an a lack of research in financial education and as a result the volume of information is low and it should be enriched by new studies. In Romania, the diagram shows a limited number of relevant extended studies in the field of financial education and entrepreneurial training shows a complete lack of relevant links.

5. Conclusions

The analysis preformed in this study produced results that indicate the need to define new organizational strategies designed to fulfil the requirements of a modern education system.

The bibliometric analysis facilitates the effort to map the comparative evolutions of different study items and to build solid databases able to contribute to the development of a new research field by using new and significant methods.

These results allow researchers to have an overview of the subject matter, to identify missing knowledge, and to launch new research ideas, contributing to the development of this area of study. The surveys performed at European level and the statistics included in articles reviewed in the Scopus database show clearly the need to conduct research studies in field of education and to assess its role in generating a new economic mindset.

This study has shown that the financial literacy is under-researched and will continue with future bibliometric analysis and further contributions to find the most effective solutions to build and consolidate financial literacy.

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The Impact of Digitalization and Digital Transformation on the Tourism Industry: A Bibliometric Analysis of Research Trends and Directions

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Abstract

This study explores the impact of digitalization on the tourism industry through a bibliometric analysis of the literature, focusing on the main research clusters and future directions. Using the Scopus database and the VosViewer visualization tool, 298 articles were analyzed, and the results indicate the existence of three major clusters. The first cluster focuses on digital transformation and innovation in tourism, highlighting how digitalisation is redefining operational processes and improving services. The second cluster highlights the role of digitalisation in adapting the tourism sector to global challenges, especially in the context of the COVID-19 pandemic. The third cluster explores the link between digitalization and sustainability, emphasizing interest in responsible tourism and emerging technologies such as smart tourism and social media. Based on these clusters, the study suggests future research directions, including deepening the relationship between digitalization and sustainability, comparative studies between markets, and analyzing the impact of advanced technologies on the personalization of tourism experiences. The conclusions highlight the importance of digitalisation as a transformative force in tourism, providing a basis for the development of sustainable and innovative strategies in a digitalised environment.

Key words: Tourism, digitization, bibliometric analysis, VosViewer, Scopus

J.E.L. classification: Z32, C1, B26, F63

1. Introduction

The emergence of digital technology has led to significant changes in the business world, influencing various industries, including tourism. These technologies have fundamentally altered the nature of the competitive landscape in multiple areas. Ever-changing consumer habits are driving organizations to take a strategic approach to digital transformation. Tourism, a key sector of the digital economy, uses these technologies to provide streamlined services and improve customer experiences. Digital technologies have become key drivers of transformation, altering tourism companies, services, and business ecosystems (Sigala, 2018). The implementation of digital technology has had a positive impact on the attractiveness, efficiency, inclusiveness and long-term sustainability of tourism (UNWTO, 2022).

The digitalization and digital transformation of the tourism industry have had a profound impact on business operations, marketing strategies, consumer behavior, and knowledge management, generating significant organizational and policy implications for the sector (Schönherr et al., 2023). In support of this observation, the tourism sector was a pioneer of digital innovation, being among the first industries to adopt the digitization of operations globally by implementing online reservations for flights and hotels. The use of information and communication technologies (ICT) in industry dates back to the 1970s, with the introduction of computer reservation systems (CRS) and continuing in the 1980s with the development of global distribution systems (GDS) (Buhalis et al., 2011).

Travel service providers are increasingly adopting cutting-edge digital technologies to enhance customer engagement. These technologies provide improved insights into consumer preferences and operational performance. A variety of technological tools, including artificial intelligence, blockchain, machine learning, the Internet of Things, big data, virtual and augmented reality, smart devices, sensors, robots, drones, beacons, ubiquitous computing, and proximity communications, among others, are driving this transformation in the tourism industry (Samala et al., 2020). Although digitalization and digital transformation in the tourism industry are considerable and distinct phenomena, researchers have made little effort to systematically organize the literature. Although research on the applications of information and communication technologies (ICT) in tourism has evolved into a significant body of knowledge as a field of scientific investigation (Buhalis, 2020; Sigala, 2018), further studies are needed to better understand the prospects of digitalisation and digital transformation in this sector. Rapid advances and the diffusion of cutting-edge digital technologies, as well as the digitalisation and digital transformation of tourism, require an up-to-date review of the existing academic literature. In addition, the in-depth analysis of research at the intersection of digital technologies and the tourism industry has not received sufficient attention (Kumar et al., 2023). While the relevance of digitalization and digital transformation in the tourism industry is undeniable, it is necessary to gain a complete understanding of the current state and future directions of research in this area (Cheng et al., 2023). Starting from these premises, we aim to fill these gaps using a bibliometric research method. Recently, bibliometric analysis has become a powerful method to understand the structure of research fields, including in tourism (Chen et al., 2022; Fauzi, 2023). Therefore, it is essential to examine the broader context, retrospectively, to determine the current area, characteristics, and possible directions for future research.

The present study aims to carry out an exhaustive bibliometric analysis of the existing academic literature, focusing on digitalization and research in the tourism industry. In line with the previous discussion, this study aims to answer the following research questions: RQ1. What are the main research clusters? RQ2. What are the future directions of research?

2. Literature review

Digitalization and digital transformation are frequently among the key priorities of modern managers (Mikalef and Parmiggiani, 2022). In academic literature, the terms digitalization and digital transformation are often used synonymously (Saarikko et al., 2020). Although these concepts are interconnected, it is important to differentiate them from a business perspective. Digitalization refers to the use of digital technologies to modify and optimize existing business processes, such as distribution, communication or relationship management, with the aim of reducing costs and improving processes, with the potential to enhance customer experiences. In contrast, digital transformation is the most extensive stage of the digital change that a firm undertakes, characterizing a comprehensive change that favors the creation of innovative business models, which go beyond the simple digitization of individual processes or tasks (Verhoef et al., 2021). and a dynamic business environment (Guinan, Parise and Langowitz, 2019; Gómez-Trujillo and González-Pérez, 2022).

3. Research methodology

In order to carry out the bibliometric analysis of research on the relationship between „tourism” and „digitalization,” this paper followed a systematic and structured approach, focused on selecting, extracting and interpreting relevant data from the academic literature. The process of identifying the articles was carried out through the Scopus database, one of the most comprehensive sources of internationally recognized scientific literature, ensuring a rigorous coverage of the areas of interest.

In the search, the keywords „tourism” and „digitalisation” were used to isolate thematically relevant works. In addition, the following selection criteria were applied: the type of document was restricted to articles, excluding other forms of publication, such as conference papers or reviews, in order to maintain a focus on published academic outputs. English was chosen as the language of reference, due to its global recognition in the academic literature and its extensive accessibility. The „final publication level” filter was also imposed to include only articles reviewed and published in final form, excluding materials in the pre-publication or revision stage.

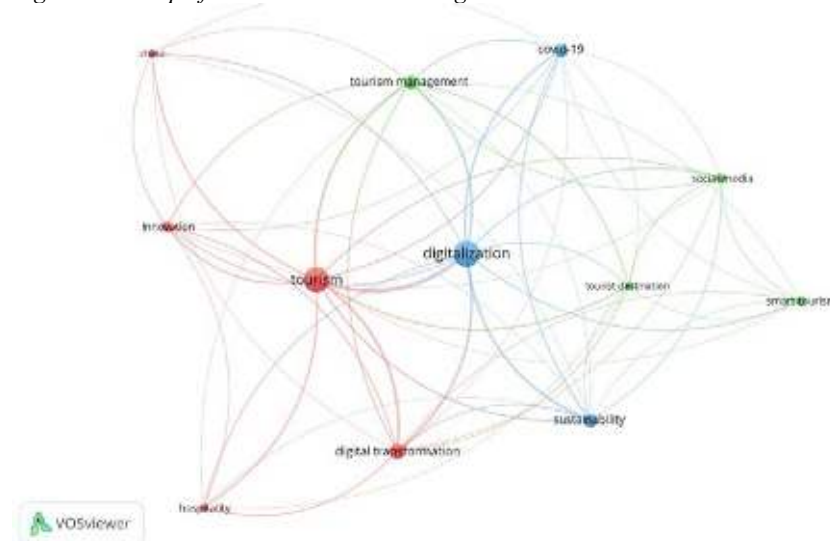
After applying these criteria, the bibliographic and citation data of the 298 selected articles were exported to the VosViewer software. VosViewer is a tool dedicated to bibliometric analysis and visualization of relationships between terms, authors and publications, facilitating the graphical representation and analysis of citation and co-occurrence networks of keywords. The export of the data in the format compatible with VosViewer allowed an in-depth interpretation of the central themes and research clusters in the academic literature, providing an overview of the field of study.

In VosViewer, the analysis aimed to identify and group the main research themes and examine the interconnections between them. Co-occurrence networks were created to highlight the frequency and distribution of concepts within the selected articles, as well as citation networks to determine the influence of authors and fundamental works in the field studied. This methodological approach ensures a clear and rigorous structuring of the existing literature, contributing to the identification of potential gaps in academic research on digitalization in tourism and to substantiate future directions of investigation.

4. Findings

In the context of rapid digital transformations, the tourism industry has extensively integrated emerging technologies such as artificial intelligence, blockchain, big data and the Internet of Things to optimize operations and improve the customer experience. Digitalization and digital transformation have become essential elements for the competitiveness of the tourism sector, contributing to the innovation of business models and adaptation in a business environment characterized by volatility, uncertainty, complexity and ambiguity (VUCA). However, the literature on the impact of digitalization in tourism remains fragmented, and a systematic understanding of the evolution and research trends in this field is needed. The present study aims to explore the mapping of the academic literature on digitalization in tourism, through a bibliometric analysis, in order to identify the main research clusters and suggest future directions relevant to this field.

Figure no. . Map of the relations between digitalization and tourism – Visualization of Major Clusters



Source: Own processing

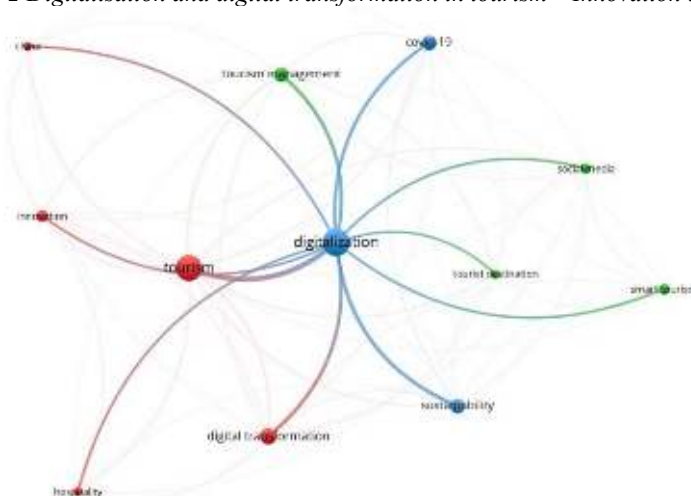
The network map generated in VosViewer (Figure no.1.), provides an overview of the main research topics around digitalization and digital transformation in the tourism industry, illustrating close links between key concepts and highlighting major directions of academic interest in this field. Central to the network is the term „digitalization”, which relates to critical topics for tourism, such as sustainability, the impact of the COVID-19 pandemic, digital transformation, consumer experience, and the development of smart tourist destinations.

The map’s analysis indicates that digitalisation is seen as a catalyst for innovation and adaptability in the face of rapid change and global challenges, such as the COVID-19 crisis. This interdependence between digitalization and sustainability suggests a research direction that explores the role of technology in reducing the environmental impact of tourism and in supporting responsible and sustainable tourism. At the same time, strong connections with terms such as „smart tourism” and „social media” show the importance of digital technologies in personalizing tourism experiences and influencing tourists’ perception of destinations.

The structure of the network also suggests an openness to comparative studies that could look at the different implementation of digitalization in different regions and tourism markets, reflected in terms such as „China”. This comparative approach would allow for a more nuanced understanding of how digitalisation is adopted and integrated according to the characteristics of the markets and their cultural or economic specificity.

Based on these observations, it can be concluded that research around digitalization in tourism is focused on two major directions: exploring the technological impact on tourism experiences and destination management, and analyzing how digitalization supports the sustainability and resilience of the industry in the face of global challenges. The network map also suggests new research opportunities, such as deepening the role of artificial intelligence, augmented reality and other emerging technologies in personalizing tourism experiences, as well as exploring strategies to adapt to rapid changes in the global environment, especially in crisis contexts.

Figure no. 2 Digitalisation and digital transformation in tourism – Innovation and transformation cluster



Source: Own processing

Figure no. 2 represents the keyword network of the central cluster around „digitalization” in tourism. This cluster draws attention to the interdependencies between digitalisation and several relevant topics in the field of tourism, e.g. „tourism”, „digital transformation”, „sustainability”, „innovation” and „COVID-19”. Such an analysis describes the crucial role of digitalisation as a driver of transformation and innovation in the tourism sector.

The word digitalization holds the center in the cluster, emphasizing its central function as a vector of change in the tourism industry. Sigala (2018) argues that digitization encourages innovation and modernization of tourism experiences and is conducive to the development of new business models in response to global market demands and globalizations. Its association with other pertinent terms attests to the centrality of digitalization in framing trends and stimulating innovations in tourism.

Digitalisation is rather associated with „innovation” and „digital transformation”, so it may imply that digitalisation in the tourism sector is not just about implementing digital technologies, but about changing the industry’s processes and services. In addition, Buhalis et al. (2011) argue that digitization also enables innovation and operational efficiency and competitiveness in operation, so that the competitiveness of the industry can seek a boost. In addition, the relationship between the „sustainability” of digitalization has brought to the fore the value of using digital technology for

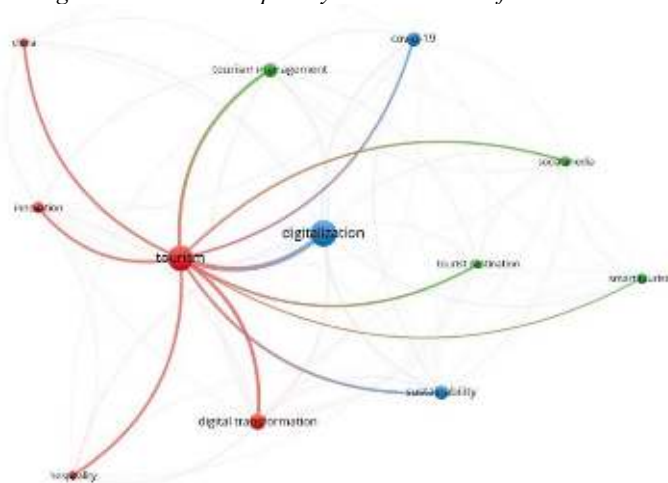
sustainable tourism, a perspective also presented by Gomez-Trujillo and Gonzalez-Perez (2022). This brings a research direction in relation to how technology can mitigate environmental effects, as well as improve responsible practices.

The association of „COVID-19” and „digitalization” signifies a rapid follow-up to the adoption of special technologies for tourism, as discussed by Cheng et al. (2023). Travel companies have invested in digital solutions for support, post-crisis recovery and future resilience. As Anbu et al. (2022) points out that the health crisis has forced travel companies to invest in digital solutions to maintain their operations in times of crisis and to recover from the crisis.

The business model in the sector needs further analysis on how digitalization and digital transformation can contribute to its redefinition (Kumar et al., 2023). He also suggested that sustainability can be supported through digitalization by reducing the industry’s ecological footprint. Therefore, this research direction is specifically concerned with how technology can contribute to greener and more responsible tourism. Further research should also study how the tourism sector „adopts [...] practices in conditions of global crisis”, focusing in particular on organizational resilience (Guinan, Parise, & Langowitz, 2019).

This cluster places digitalization at the epicenter of the transformation in tourism, which is related to innovation in sustainability and even global crisis management, as deeply affected areas. The study demonstrated that digitalization is a necessity for the sustainable development and adaptability of the industry in such a complex and unpredictable global context.

Figure no. 3 Digitalization and Hospitality – Tourism transformation and innovation cluster



Source: Own processing

The second group of terms related to „tourism” in terms of digitisation is shown in Fig. 3, demonstrating the associations between „tourism” and adjacent themes such as „innovation”, „digital transformation”, „hospitality” and „China”. This reflects an increased focus in the literature on how digitization catalyzes change in tourism as an innovation support sector, a prominent point highlighted by Sigala (2018) regarding the contribution of technology to changing business models and consumers. Experiences.

The term „tourism” is in the middle of this cluster, with „digital transformation” and „innovation”, showing how digitalization substantially helps to modernize processes and create new tourism-specific business models. As Buhalis et al. (2011) notes that digital technologies have made industry processes simpler and improved the tourism experience while becoming globally competitive. Here are connections to what has been a concern in the literature – the need to bring new technologies to the tourism industry and transform traditional practices through digital innovation.

As such, the interrelationship between „tourism” and „hospitality” states that digitalisation is not only impacting the tourism industry, but is equally extended to the associated hospitality sector. As Verhoef et al. (2021) observed that incorporating digital technology into hospitality helped the work process become more efficient and supported the management of customer experiences by optimizing touchpoints and personalizing services, this involves delivery. This association describes

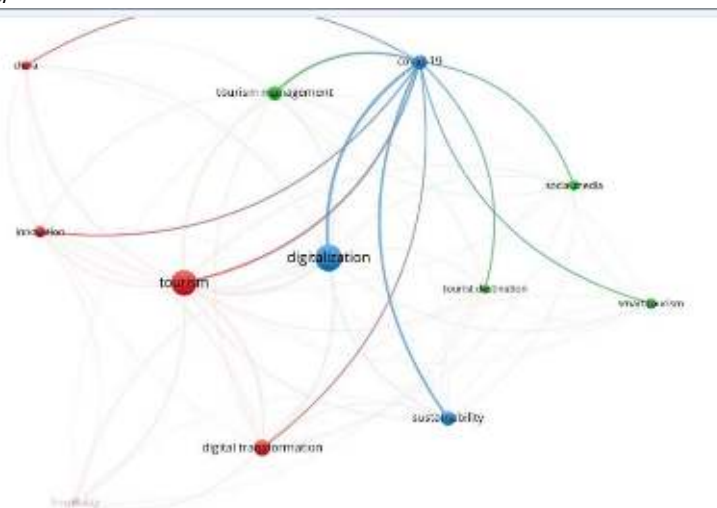
the acceptance of technology in accommodation services, showing how digitalization is transforming the tourist experience for better efficiency and personalization interaction.

The word „China” shows an obvious academic interest in the Chinese tourism market in the context of digitalization, or in the innovative manner of this region in the application of digital technologies in tourism. According to Cheng et al. (2023), in emerging markets such as China, more innovative models on digitalization could be offered, which would be worthy of comparison with those in developed markets for the purpose of identifying globally applicable lessons. The same observation implies the possibility of comparative research that could highlight the different and similar aspects between implementation strategies in emerging versus developed markets.

The cluster emphasizes that digitization is a transformative factor, and ICT a cornerstone for modernization and innovation in the tourism and hospitality sector. Research pathways should, as Mikalef and Parmiggiani (2022) also suggest, examine how digital transformation redefines business models and operational practices in tourism and the impact on processes and services, or in other words, a kind of „adaptation” of digitalization. emerging markets, such as China. It would provide insightful new lessons on how emerging markets could innovate in the direction of digitalisation. Perhaps, examining how technology is intertwined in the provision of tourism and hospitality services can bring to the fore issues related to digital technologies that ensure the personalization and efficiency of consumer experiences as added values that contribute to increased levels of customer satisfaction (Saarikko et al., 2020).

This set focuses on the strategic role of digital transformation and innovation in reframing tourism and hospitality, highlighting the great influence of technology on the business model and customer experience.

Figure no. 4 Digitalization in the context of COVID-19 and sustainability – Smart tourism and social networks cluster



Source: Own processing

The image shows the third group of terms „digitalisation” and „tourism” with the terms „COVID-19”, „sustainability”, „smart tourism”, „social media” and „tourism management”. Such a structure implies a strong correlation of digitalization with various critical functions of the tourism sector and demonstrates how technology challenges not only tourism operations, but experiences themselves (Sigala, 2018; Verhoef et al., 2021).

Digitalisation is centrally positioned around „COVID-19”, underlining the major role of the pandemic as a catalyst for rapid digitalisation in the tourism industry (Cheng et al., 2023). „Global health crisis – fundamental changes in the functioning of the sector...” and „Rapid implementation of social distancing technologies and aggressive promotion of destinations in the online sphere”, as stated by Cheng et al. (2023) further summarises the situation that needs to be made conducive to digitalisation and this difficult challenge. The above case thus illustrates how, during a crisis, the

sector can resort to digital solutions developed to maintain its core functions in times of great turbulence.

The link between „digitalization” and „sustainability” reflects the academic concern for a more responsible and sustainable tourism, and this through the instrumentality of digital technologies. According to Gomez-Trujillo and Gonzalez-Perez (2022), digitization can be a backbone for supporting sustainability initiatives by optimizing resources and reducing the industry’s ecological footprint. This reveals a deep interest in the body of literature on how green and responsible tourism can be developed through digital technology, infrastructure for the creation of sustainable and efficient industrial practices.

The relationship between „digitalization”, „smart tourism” and „social media”, between them, shows the desire to apply advanced technologies and social networks for the personalization and optimization of tourism experiences. Buhalis et al. (2011) argue that smart tourism integrates digital technologies to create smart destinations where visitor experiences are enhanced and effective destination management is at stake. In this perspective, social networks are significant in the perception and decision-making of tourists and form an integral part of contemporary digital marketing in promoting destinations and adapting consumer needs and preferences.

The above literature gaps should guide further research. First, the research will investigate how digital enables the tourism industry to cope with the pandemic and to what extent the digital line can support the resilience of the sector in terms of the global crises that will come in the future. Second, it recommends exploring the impact of digitalisation on the sustainability of tourism, given that digital technologies are a potential force in reducing the negative impact of environmental issues and promoting responsible and environmentally friendly tourism (UNWTO, 2022). The third area where it could be a solution is exploring smart tourism and social media as emerging avenues to shed additional light on the influence of advanced technologies and social media on tourism experiences and consumer behaviors that may be conducive to personalizing and enhancing tourism experiences (Saarikko et al., 2020).

The cluster explains how the tourism industry can be digitized in a dynamic environment, full of complex changes and problems, which will benefit and help the industry to grow further. With a focus on sustainability, innovation and personalization of the tourism experience, it would seem that digitalization is an integral part of the future sustainability and competitiveness of the sector.

5. Conclusions

The present study aimed to explore the impact of digitalization on the tourism industry through a bibliometric analysis, in order to answer two essential questions: *What are the main research clusters?* and *What are the future directions of research?*

Regarding the first question, the bibliometric analysis revealed three major clusters in the literature. The first cluster focuses on digital transformation and innovation in tourism, highlighting how digitalization redefines operational processes and improves hospitality services, contributing to a superior experience for tourists. The second cluster explores the adaptation of the tourism sector to global challenges, especially in the context of the COVID-19 pandemic, where digitalisation has proven essential for crisis management and sustaining resilience. The third cluster focuses on the relationship between digitalization and sustainability, illustrating the researchers’ interest in responsible tourism and the use of advanced technologies, such as smart tourism and social media, in promoting destinations and personalizing tourism experiences.

Regarding the second question, the results suggest clear directions for future research. First of all, it highlights the need to deepen the way in which digitalization can support sustainability in tourism, by implementing ecological practices and promoting responsible tourism. Second, comparative studies across markets and regions could provide valuable insights into variations in digitalisation uptake and innovative practices that can be widely applied. At the same time, future research could analyse the impact of emerging technologies, such as artificial intelligence and augmented reality, on the tourism experience and the personalisation of services, thus contributing to increasing the competitiveness of the industry.

In conclusion, this analysis underlines the essential role of digitalization as a transformative factor in the tourism industry, with an impact on innovation, sustainability and adaptability of the sector in a dynamic and constantly changing global environment. The identified directions provide a solid basis for deepening future research and developing strategies to support the evolution of tourism in a digitized and sustainable framework.

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Analysis of the Main Components in the Evaluation of Tourism Performance in Romania (2014-2022): Essential Dimensions and Strategic Directions for Sustainable Development

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Abstract

Tourism contributes significantly to economic and social development, but in Romania it faces challenges related to the capitalization of resources and infrastructure development. This study applies the Principal Component Analysis (PCA) to data from 2014-2022, provided by the National Institute of Statistics (INS), to identify the essential dimensions influencing tourism performance. The indicators analysed include the share of tourism in GDP, international arrivals, average length of stay and regional distribution of tourist flows.

The results highlight two main dimensions: the attractiveness of destinations and the economic contribution. The first two components explain 94.77% of the total variation, Component 1 being dominated by variables associated with destinations (e.g., „Mountain”), and Component 2 by economic variables (e.g., „PondTurPIB”). The temporal evolution shows a decline in 2020 caused by the COVID-19 pandemic, followed by a partial recovery in 2021-2022.

The study contributes to understanding the dynamics of Romanian tourism and provides recommendations for public policies focused on diversification of the offer and investments in infrastructure, supporting the competitiveness and sustainability of the sector.

Key words: Tourism, analysis, destinations, economic contribution, development

J.E.L. classification: Z3, C1, B26, F63

1. Introduction

Tourism is recognized as one of the most dynamic sectors of the global economy, contributing significantly to economic development, job creation and regional income consolidation. Internationally, tourism generates about 10% of global GDP and 1 in 10 jobs (WTTC, 2022), being considered an essential pillar of sustainable development. In Romania, tourism has significant potential due to the diversity of natural and cultural resources, including varied landscapes, internationally recognized spa resorts and a valuable cultural heritage. However, Romania's tourism sector faces a number of challenges, such as insufficiently developed infrastructure, lack of effective promotion, and limited capitalization of ecotourism destinations such as the Danube Delta (Gössling & Hall, 2019).

Analysing tourism performance requires a complex approach, given the multidimensional nature of the sector. Economic indicators, such as the contribution of tourism to GDP or the number of international arrivals, must be correlated with factors related to the attractiveness of destinations, infrastructure and tourist satisfaction (Buhalis, 2000). In this context, Principal Component Analysis (PCA) is a useful method that allows identifying the essential dimensions that explain variations in a complex data set. PCA has been widely used in the literature to synthesize and interpret tourism indicators, providing a clear perspective on the key factors contributing to tourism success (Hair et al., 2010).

The dimensions identified in the literature are aligned with the results of the present research, which emphasizes the importance of two major axes: the attractiveness of destinations and the economic contribution. The attractiveness of destinations, determined by factors such as the quality of services, infrastructure and diversity of tourist activities, is a central element for attracting tourists. Previous studies show that mountain and spa destinations play a crucial role in extending the average length of stay (Smith & Puczkó, 2014). At the same time, the economic contribution of tourism, highlighted by variables such as „PondTurGDP” or „ArrivalsInternat”, confirms that tourism can function as an engine for the economic growth of regions, when it is well managed (WTTC, 2022).

The COVID-19 pandemic has highlighted the vulnerability of this sector, causing the most severe decline in tourism activity in history. The year 2020 saw a 74% reduction in international arrivals globally (UNWTO, 2021), and Romania was no exception. Travel restrictions and border closures have significantly affected international tourism, but domestic tourist flows to less crowded destinations, such as mountain and rural resorts, have increased (Sigala, 2020). In this context, analysing the evolution of tourism over the last decade is essential to understand trends and develop strategies to support the resilience of this sector.

The present research is based on data taken from the statistics of the National Institute of Statistics (INS) for the period 2014-2022, including essential indicators for tourism analysis, such as the share of tourism in GDP, the number of international arrivals, the average length of stay and the distribution of tourist flows in the main regions of Romania. By applying the ACP, this research aims to synthesize the complexity of the data in a simplified model, highlighting the relationships between the analyzed variables and identifying the determinants of tourism performance.

The objectives of this study are the following: (1) to identify and interpret the essential dimensions that influence the performance of tourism in Romania, with a focus on the attractiveness of destinations and the economic contribution; (2) analysis of the impact of the COVID-19 pandemic on the evolution of tourism in the period 2014-2022; and (3) substantiating practical recommendations for the sustainable development of tourism, in line with international trends and good practices. This research contributes both to a deeper understanding of the dynamics of the tourism sector in Romania, and to the development of public policies designed to support the increase of competitiveness and sustainability of this vital sector.

2. Literature review

Tourism plays a central role in the economic and social development of many countries, and the literature highlights the complexity of the factors influencing the performance of this sector. One of the most widely used methods for the analysis of these factors is Principal Component Analysis (PCA), which allows the identification of essential dimensions in a complex set of data. According to Hair et al. (2010), ACP is a robust method for reducing data size and eliminating redundancy in situations where variables are strongly correlated, as is the case in the present study. This technique is frequently used in tourism to understand the relationships between economic, social, and geographic variables.

The dimensions identified in this research, namely the attractiveness of the destinations and the economic contribution, are consistent with the theory of the „four A's” (attractiveness, accessibility, amenities, ancillary services), proposed by Buhalis (2000). The attractiveness of destinations is a central factor in tourists' decision to visit a region. Studies indicate that mountainous, spa and seaside areas are preferred for the diversity of recreational activities and health benefits (Smith & Puczkó, 2014). At the same time, quality infrastructure and ancillary services contribute to the average length of stay, which is also highlighted by the high scores of the variables „DurMedSed” and „Mountain” in this research.

The economic contribution of tourism is another key pillar, reflected by variables such as 'PondTurGDP' and 'Arrivals'. According to WTTC (2022), tourism contributes directly and indirectly to economic growth, stimulating other industries and creating jobs. However, Gössling and Hall (2019) warn that tourism development must be managed sustainably in order to avoid negative effects on the local environment and culture. In Romania, this challenge is highlighted by the weaker positioning of regions such as the Danube Delta, which, although it has a high ecotourism potential, requires significant investments in infrastructure and promotion.

A major turning point for global tourism has been the COVID-19 pandemic, which has had a devastating impact on the sector. The UNWTO (2021) reports a 74% drop in international arrivals in 2020, which has led to massive economic losses worldwide. Sigala's studies (2020) point out that the tourism recovery has been different from one region to another, influenced by the strategies adopted to respond to the crisis. In Romania, domestic tourism has seen an increase during the pandemic, especially in mountainous and rural areas, as tourists have sought safer and less crowded destinations. However, this trend was not enough to compensate for the losses in international tourism.

Regarding the post-pandemic evolution, WTTC (2022) points out that the recovery of the sector has been driven by the pent-up demand for travel, but also by the industry's adaptation to the new requirements. Investments in digitalization and the promotion of lesser-known destinations have played a crucial role in attracting tourists, both domestic and international. This observation is relevant for Romania, where areas such as the Danube Delta or other rural regions have the potential to become hotspots, provided they benefit from adequate investment and promotion.

The literature provides a valuable framework for interpreting the results of this research. The dimensions identified by the ACP confirm global trends in tourism, underlining the importance of destination attractiveness and economic contribution. At the same time, the challenges related to sustainability, infrastructure and promotion remain relevant, and the results of the research can contribute to the foundation of public policies aimed at the sustainable growth of the tourism sector in Romania.

3. Research methodology

The data used in this study were taken from the official statistics of the National Institute of Statistics (INS) in Romania. These include important indicators for tourism, such as the share of tourism in GDP (PondTurPIB), the number of employees in the industry (NrSal), tourist arrivals and overnight stays, the average length of stay (DurMedSed), but also detailed information about specific destinations such as the seaside, spa resorts, mountain areas, the Danube Delta, Bucharest and other regions. The dataset covers the period 2018-2022, providing an overview of the performance of tourism over the past five years.

Before applying the analysis method, the data was processed to ensure a correct interpretation. Since the variables are measured in different units, they have been standardized using the z-score method. Standardization was necessary to eliminate the influences of scale on the analysis and to allow direct comparison between variables. Also, some transformations were applied to convert values such as „DurMedSed” from text format (where the comma was used as a decimal separator) to numeric format.

The data analysis was performed using the SPSS program, which is well known for its advanced statistical processing tools. Principal Component Analysis (PCA) was applied to identify latent data structures and reduce their size. ACP is an ideal method for analyzing complex data sets, as it synthesizes information into principal components, each explaining a significant part of the total variation. In the analysis, the correlation matrix was used, so that the relationships between the variables were not influenced by the differences in scale.

The selection of the main components was made based on several criteria. First, components that had eigenvalues greater than 1 were kept. The cumulative variance explained by the selected components was also intended to be at least 80% to ensure that the analysis captures the most important dimensions of the data. Each main component has been interpreted according to the loads of the associated variables (loadings), providing clear clues about the main relationships and factors influencing tourism.

Table no. 1 Analyzed indicators

Anii	PondTurPIB	NrSal	SosirInternat	InoptărilInternat	SosirIntern	InoptărilIntern	DurMedSed	Litoral	Balnear	Montan	Delta	Buc	Alte
2022	2,392	5209493	1,674,000	3,667,000	10,914,000	23,377,000	2,1	1,366,000	890,000	3,515,000	495,000	1,981,000	3,954,000
2021	1,741	5,094,288	1,581,065	3,458,858	9,718,046	20,860,755	2,2	1,244,000	813,000	3,358,000	597,000	1,983,000	3,741,000
2020	1,596	5,031,767	454,000	997,000	5,945,000	13,582,000	2,3	772,000	620,000	2,370,000	272,000	1,582,000	2,994,000
2019	2,981	5,164,471	2,684,000	5,291,000	10,691,000	24,795,000	2,2	848,000	597,000	2,342,000	254,000	1,535,000	2,826,000
2018	2,909	5,068,063	2,797,000	5,330,000	10,108,000	23,315,000	2,2	766,000	594,000	2,374,000	286,000	1,545,000	2,888,000
2017	2,787	4,945,868	2,760,000	5,291,000	9,383,000	21,802,000	2,2	776,000	577,000	2,270,000	125,000	1,472,000	2,685,000
2016	2,765	4,759,419	2,481,000	4,832,000	8,522,000	20,609,000	2,3	701,000	486,000	1,878,000	136,000	1,433,000	2,312,000
2015	2,399	4,611,395	2,240,000	4,472,000	7,682,000	19,047,000	2,4	686,000	479,000	1,822,000	138,000	1,450,000	2,246,000
2014	1,961	4,507,729	1,915,000	3,768,000	6,551,000	16,512,000	2,4	690,000	451,000	1,609,000	138,000	1,318,000	1,924,000

Source: Own processing according to INS data

The results were presented in the form of suggestive visualizations. The Scree plot plot allowed the optimal number of components to be clearly identified, and the Biplot plot provided a picture of the relationships between variables and principal components. These visual representations are useful for understanding how individual indicators contribute to the main components.

While the analysis is robust, there are also limitations. The dataset includes only nine years of observations, which may influence the generalizability of the results. However, the application of the PCA has made it possible to reduce redundancies in the data and highlight key relationships. The high multicollinearity observed between the variables was effectively addressed by this method, facilitating a clear interpretation of the determinants of tourism.

This methodological approach provides a solid framework to analyze and understand the main dimensions that contribute to the development of tourism in Romania.

4. Findings

In the context of rapid digital transformations, the tourism industry has extensively integrated emerging technologies such as artificial intelligence, blockchain, big data and the Internet of Things to optimize operations and improve the customer experience. Digitalization and digital transformation have become essential elements for the competitiveness of the tourism sector, contributing to the innovation of business models and adaptation in a business environment characterized by volatility, uncertainty, complexity and ambiguity (VUCA). However, the literature on the impact of digitalization in tourism remains fragmented, and a systematic understanding of the evolution and research trends in this field is needed. The present study aims to explore the mapping of the academic literature on digitalization in tourism, through a bibliometric analysis, in order to identify the main research clusters and suggest future directions relevant to this field.

Figure no. 1 Correlation matrix

		Correlation Matrix ^{a,b}												
		PondTurPIB	NrSal	SosirInternat	InoptărilInternat	SosirIntern	InoptărilIntern	DurMedSed	Litoral	Balnear	Montan	Delta	Buc	Alte
Correlation	PondTurPIB	1.000	.139	.900	.889	.615	.776	-.296	-.244	-.238	-.205	-.378	-.301	-.202
	NrSal	.139	1.000	-.105	-.064	.684	.519	.722	.659	.793	.808	.687	.719	.856
	SosirInternat	.900	-.105	1.000	.994	.543	.730	-.366	-.292	-.349	-.301	-.394	-.369	-.342
	InoptărilInternat	.889	-.064	.994	1.000	.608	.782	-.279	-.196	-.268	-.220	-.312	-.281	-.268
	SosirIntern	.615	.684	.543	.608	1.000	.966	.535	.581	.573	.609	.476	.532	.583
	InoptărilIntern	.776	.519	.730	.782	.966	1.000	.311	.373	.345	.385	.255	.308	.355
	DurMedSed	-.296	.722	-.366	-.279	.535	.311	1.000	.964	.977	.983	.962	1.000	.969
	Litoral	-.244	.659	-.292	-.196	.581	.373	.964	1.000	.968	.960	.921	.966	.924
	Balnear	-.238	.793	-.349	-.268	.573	.345	.977	.968	1.000	.995	.928	.977	.987
	Montan	-.205	.808	-.301	-.220	.609	.385	.983	.960	.995	1.000	.937	.982	.992
	Delta	-.378	.687	-.394	-.312	.476	.255	.962	.921	.928	.937	1.000	.963	.922
	Buc	-.301	.719	-.369	-.281	.532	.308	1.000	.966	.977	.982	.963	1.000	.968
	Alte	-.202	.856	-.342	-.268	.583	.355	.969	.924	.987	.992	.922	.968	1.000

a. Determinant = .000

b. This matrix is not positive definite.

Source: Own processing

The correlation matrix (Figure no. 1.) indicates the relationships between the variables included in the analysis, highlighting both strong positive correlations and significant negative correlations.

High positive correlations, such as that between „Arrivals” and „Arrivals” (0.994), underline the fact that the number of international arrivals is closely linked to the length of stay of these tourists. This result is supported by the literature, which indicates that international tourists are more likely to stay for longer periods in destinations that offer diverse amenities and a quality experience (Dwyer et al., 2008).

In contrast, negative correlations, such as between „PondTurGDP” and „Delta” (-0.378), suggest that certain natural regions, although ecologically valuable, do not contribute significantly to the national GDP through tourism. This observation is confirmed by studies showing that eco-tourism in areas such as the Danube Delta requires more investment to reach its economic potential (Weaver, 2006).

The high multicollinearity observed in the matrix (e.g., the zero determinant) is commonly encountered in studies looking at interrelated variables. The literature recommends the use of PCA to reduce information redundancy (Hair et al., 2010).

Figure no. 2 Variation explained

Component	Total Variance Explained					
	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	8.111	62.392	62.392	8.111	62.392	62.392
2	4.209	32.378	94.770	4.209	32.378	94.770
3	.480	3.696	98.466			
4	.108	.828	99.293			
5	.044	.337	99.631			
6	.038	.292	99.922			
7	.009	.066	99.989			
8	.001	.011	100.000			
9	8.573E-16	6.595E-15	100.000			
10	1.699E-16	1.307E-15	100.000			
11	3.335E-17	2.566E-16	100.000			
12	-5.591E-17	-4.301E-16	100.000			
13	-3.240E-16	-2.492E-15	100.000			

Extraction Method: Principal Component Analysis.

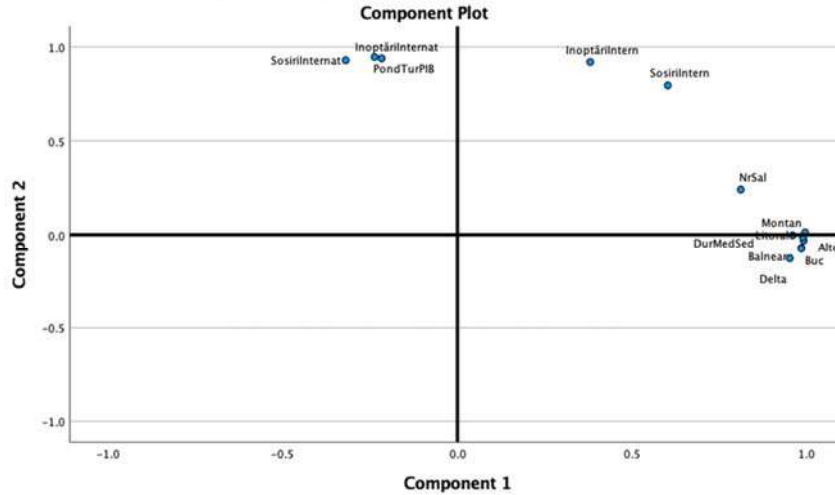
Source: Own processing

Figure no. 2 on the explained variance indicates that the first two main components retain 94.77% of the total variation, which suggests that these two components synthesize most of the information in the dataset.

Component 1 accounts for 62.39% of the variation and is dominated by destination-related variables such as „Mountainous,” „Spa,” and „Seaside.” This can be interpreted as the dimension of „attractiveness of destinations”. Component 2 explains 32.38% of the variation and is strongly correlated with economic variables, such as „PondTurGDP” and „ArrivalsInternat”, representing the „economic” dimension. The literature emphasizes the importance of these two dimensions. The destination attractiveness component (Component 1) is supported by regional development theory, which shows that diversification of tourist attractiveness (e.g. mountain and spa areas) increases tourist flows (Dwyer et al., 2008). The economic component (Component 2) is frequently mentioned as a key factor in the literature, with studies showing that tourism contributes directly to GDP growth through tourism expenditure and indirectly through the development of associated industries (WTTC, 2022).

International studies emphasize that the attractiveness of destinations and the economic contribution are two fundamental pillars of tourism development (Buhalis, 2000; WTTC, 2022). The identification of these two dimensions confirms that Romania aligns with global trends, but requires differentiated strategies to develop each dimension in a sustainable way.

Figura no. 3 Plot component (Biplot)



Source: Own processing

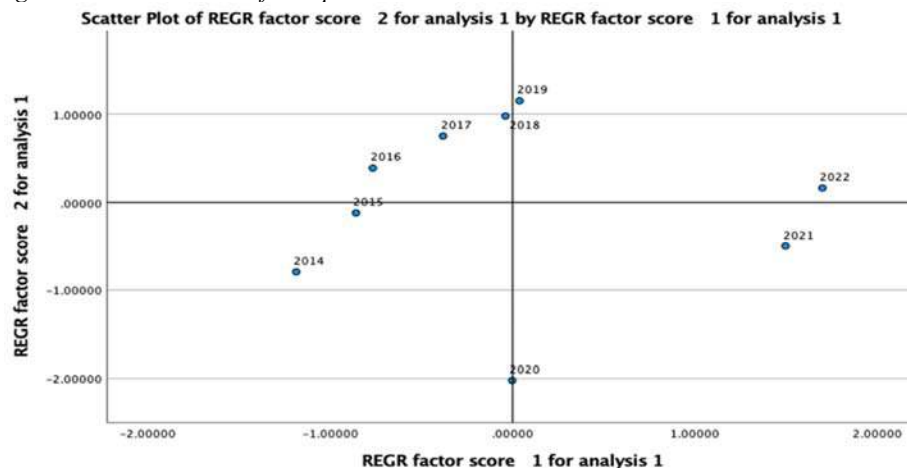
Figure no. 3 Biplot illustrates the positioning of the variables in relation to the two main components, providing a clear picture of the relationships between them.

Economic variables, such as 'PondTurGDP' and 'Arrivals', are positioned along Component 2, suggesting that they contribute significantly to the economic dimension. On the other hand, the variables „DurMedSed”, „Mountain” and „Spa” are strongly correlated with Component 1, emphasizing their connection with the attractiveness of destinations.

Variables such as „Delta” and „Buc” have less central positions, indicating less influence on the two main components. This may reflect the limitations of these regions in attracting a large number of tourists or in their overall economic contribution.

The identified dimensions are aligned with the model of the four A's (attractiveness, accessibility, amenities, and ancillary services) proposed by Buhalis (2000). Destinations that support the average length of stay (such as Montan and Balnear) reflect the attractiveness and facilities offered, while economic variables (e.g., „PondTurPIB”) demonstrate the contribution of tourism to the national economy. In addition, the placement of variables such as the Delta at the bottom suggests challenges in the sustainable use of natural heritage, an aspect extensively analyzed in the literature on ecological tourism (Weaver, 2006).

Figure no. 4 Scatter Plot of Component Scores



Source: Own processing

Figure no. 4 Scatter Plot offers a clear perspective on the evolution of tourism in Romania during the analyzed period, highlighting the variations in its performance based on the two main components: the attractiveness of the destinations and the economic contribution. The comparative analysis of the periods 2014-2016, 2020 and 2021-2022 highlights the dynamics of the tourism sector under the influence of economic, social and global factors.

The years 2014-2016 are characterized by negative positioning on both main components, suggesting a poor overall performance of Romanian tourism. On the economic dimension, this period indicates a low contribution of tourism to GDP, a low number of international arrivals and an underdeveloped infrastructure. In terms of the attractiveness of destinations, the negative scores reflect an insufficient use of the potential of key tourist regions, such as mountain and spa areas.

These observations are supported by the literature, which identifies the lack of a coherent promotion strategy and limited investments as determinants of the low performance during this period. Gössling and Hall (2019) point out that poor infrastructure and poor quality services limit the competitiveness of tourism, especially in rural and natural regions. In addition, the post-global crisis economic period of 2008-2009 continued to affect tourism in Eastern Europe, leaving visible traces in its dynamics.

The year 2020 represents a severe inflection point in the evolution of tourism, being strongly affected by the COVID-19 pandemic. The very low positioning on the economic dimension reflects the massive reduction in international arrivals, border closures and travel restrictions imposed globally. In contrast, the attractiveness of destinations has remained relatively stable, due to the increase in domestic tourism in less crowded regions, such as mountain resorts and spas.

The literature confirms the extent of the pandemic's impact on the tourism sector. The UNWTO (2021) indicates that 2020 was the most difficult year in the history of global tourism, with a 74% drop in international arrivals. In Romania, this global trend has been accentuated by a high dependence on international tourism in certain regions, such as Bucharest and the seaside. However, mountain and spa resorts have seen a slight increase in the flow of domestic tourists, due to the preference for safer destinations closer to home (Sigala, 2020).

The years 2021 and 2022 mark the beginning of a recovery for the tourism sector, but with distinct dynamics. In 2021, the negative positioning on the economic dimension suggests a still low economic contribution, caused by the reluctance of international tourists and the uncertain conditions related to the pandemic. However, the size of the attractiveness of destinations shows a slight increase, driven by the resumption of tourist activities and the partial relaxation of restrictions.

In 2022, a significant recovery on the economic dimension is observed, indicating an increase in tourism's contribution to GDP and an intensification of international arrivals. This development is supported by the easing of travel restrictions, the reopening of borders and the increase in pent-up demand for travel. The attractiveness of destinations remains positive, but without a significant improvement compared to the previous year.

According to WTTC (2022), the recovery of global tourism in 2022 was driven by strong demand for travel, especially to safe and affordable destinations. However, studies highlight that this recovery has not been uniform, being influenced by the infrastructure and adaptation strategies of each region.

Comparing these periods, it becomes apparent that the years 2014-2016 were characterised by structural constraints and poor overall performance. The year 2020 represents an unprecedented crisis point, underlining the vulnerability of the tourism sector to global shocks. On the other hand, the years 2021 and 2022 indicate a gradual recovery, with a more pronounced improvement in the economic dimension than in that of the attractiveness of destinations. This evolution suggests the need for public policies that support the diversification of the tourism offer, investments in infrastructure and the promotion of less valued destinations, such as the Danube Delta. The results are in line with the literature, which emphasizes the importance of integrated strategies and adaptation to new market requirements for sustainable tourism growth.

5. Conclusions

The present research highlights the main dimensions influencing the performance of tourism in Romania between 2014-2022, using the Principal Component Analysis (PCA) to synthesize and interpret a complex set of data. The results indicate that Romanian tourism is structured on two fundamental axes: the attractiveness of destinations and the economic contribution.

The first dimension, the attractiveness of destinations, is strongly influenced by variables such as „DurMedSed” (average length of stay), „Mountainous” (mountainous areas) and „Spa” (spa resorts). These results underline the importance of key tourist regions in attracting tourists and extending the length of stays. In particular, mountain and spa resorts have demonstrated greater resilience in times of crisis, such as the COVID-19 pandemic, becoming preferred destinations for domestic tourists. This highlights the need for a strategy to diversify tourism products and improve infrastructure in order to increase the competitiveness of these regions.

The second dimension, the economic contribution, is reflected by variables such as 'PondTurGDP' (share of tourism in GDP) and 'ArrivalsInternat' (international arrivals). This confirms that tourism plays an important role in the country's economic development, especially by attracting international tourists. However, the analysis highlights an uneven contribution of different regions to the national economy, with a worse performance in areas such as the Danube Delta, which, although it has a high ecotourism potential, requires greater investment in infrastructure and promotion.

The impact of the COVID-19 pandemic on tourism is clearly highlighted in the research results, with 2020 marked by a drastic decrease in international tourism flows and economic contribution. However, this crisis has also highlighted opportunities, especially in promoting domestic tourism and lesser-known destinations. The years 2021 and 2022 show a gradual recovery, with an increase in the economic contribution and a stabilization of the attractiveness of destinations.

Based on these results, some important strategic conclusions can be drawn. First of all, Romanian tourism needs an integrated approach that combines effective promotion with investments in infrastructure and digitalization. Secondly, ecotourism destinations, such as the Danube Delta, require a dedicated strategy to become competitive attractions both nationally and internationally. Third, the pandemic has demonstrated the importance of adaptability and resilience in the face of global challenges, highlighting the need to develop flexible public policies to support tourism in times of crisis. The contribution of this research consists in providing a detailed perspective on the factors influencing the performance of tourism in Romania and in highlighting strategic directions for its development. The results are relevant for both policymakers and industry actors, providing a starting point for developing sustainable public policies and strategies that support the competitiveness and growth of this vital sector.

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The Role of Organizational Culture in Innovative Activities

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Abstract

In today's increasingly competitive environment, technology is fast development significantly changes the business environment. In the given conditions innovative behavior is an important aspect of business development.

Organizational aspects of companies are discussed and studied in the paper theoretical foundations of culture in terms of innovative activity. Right here issues of innovative culture formation and with it are discussed related problems.

The purpose of this paper is to analyze the impact organizational culture on management of innovation processes. Organizational culture is the uniqueness of each organization and defines unrepeatability. Companies with a strong culture they tend to achieve more in their operation higher efficiency than companies with low culture.

There is no doubt that it is innovative behavior that makes enterprises sustainable the key to competitiveness, culture is the best of this business supportive. Therefore, it is important for the scientific community active involvement in ongoing processes, which is related with the in-depth study of innovative processes and it's with support.

Key words: Innovation; Organizational culture; Formation of innovative culture; Innovative process; Efficiency.

J.E.L. classification: A1, M.

1. Introduction

In the modern era of globalization, global changes and the rapidly evolving competitive environment have significantly increased the need for new directions and opportunities in business. To achieve competitive advantage, it is crucial for companies to adapt to changes and implement innovations. However, this often proves challenging due to entrenched inefficient organizational cultures within companies, which frequently fail to motivate employees. As technology advances, human and intellectual resources become increasingly important. Consequently, human resource management demands greater effort and complex approaches from managers. They strive to enhance employee motivation, as organizational success largely depends on innovative approaches and the quality of work performed by employees.

A key factor in the sustainable economic development of a country is economic growth. According to classical economic recommendations, if a country's annual economic growth rate does not exceed 4%, it must adopt a sharply innovative approach to development. Otherwise, the country risks lagging so far behind that catching up with other nations in the foreseeable future becomes unrealistic (Zazadze & Rusiashvili, 2024, p. 3). Therefore, innovation processes play a significant role in economic growth and development, both at the national and organizational levels. Considering the challenging and dynamic

competitive environment, it is unsurprising that demand for innovation continues to rise. Numerous scientific studies highlight a positive correlation between innovation and desired performance outcomes.

Interest around organizational culture increased in the 2000s. and regarding innovative activities in the last 10 years. Classification of organizational culture, its types, features of innovative culture and a number of issues are not sufficiently reflected in the scientific literature. There is no consensus among scientists on the definition of the concept of "organizational culture" and its importance for the effectiveness of organizing innovative activities. The conditions under which the need for innovative culture arises have not been established. The peculiarities of innovative culture in developing countries have not been studied.

The purpose of the article is to discuss and study the role of organizational culture in the innovative activities of organizations based on the information found. The tasks of the paper are: based on the works of Georgian and foreign scientists: 1) definition-discussion of the terms - "organizational culture" and "innovative organizational culture"; 2) review of organizational culture formation issues; 3) determination of organizational culture structure; 4) in-depth study of organizational culture and innovative activities based on the sources found and used; 5) Analyzing the information found around the research topic and drawing logical conclusions, determining the relevance to the research goal.

The results of the research are interesting both for scientists and researchers in the field of economics, business and management, as well as for heads of organizations, as well as for anyone interested in this topic.

2. Literature review

In the process of working on the paper, we got acquainted with both empirical and statistical data, as well as theoretical material. The article provides for the processing of secondary analytical materials based on open sources. In the process of finding fundamental and relevant material, first of all attention was paid to the reliability of the source, its recognition and familiarity. During the research, we focused on scientific sources and reviewed the publications of both Georgian and foreign researchers on the topic, such as: to describe the organizational culture and its levels, we relied on the fundamental work of E. Schein - "Organizational Culture and Leadership" (1985), (Schein, 2004).

The term "organizational culture" has been used since the 18th century, although the development of concepts around it was unsystematic during this period.

Official documents of the Government of Georgia were also used: E.g.: In Georgia, regarding the support of innovative strategies, we discussed the government document - "Georgian Law on Innovations, 2016" (Georgia, 2016)

Internet materials: as an example of existing measures to support innovations in Georgia, we used the article found on the Internet: "The first technological park was opened in Georgia" (11.01.2016) (Kvirikashvili, 2016).

Statistical information: In order to evaluate the innovative processes in Georgia in 2019-2023, we reviewed the material- "Georgia in the Global Innovation Index". (Dutta & Lanvin, 2020); (Information, 2024)

In the process of searching for sources, we got to know and discussed the recommendations of various experts. All sources are indicated in the main text of the work and in the bibliography. In the first stage of working on the article, the actual material found was studied and processed, and in the next stage, an in-depth, fundamental analysis of the obtained data took place, which was formulated in the form of conclusions in the paper.

3. Research methodology

The research paper is a general-scientific study. Its methodological foundation comprises theoretical-empirical research methods, statistical analysis, and logical approaches.

The research is based on secondary data, ensuring methodological reliability, accuracy, and replicability. The theoretical foundation of the study draws on the works of Georgian and international researchers in the fields of organizational culture and innovation management. Additionally, it utilizes official documents from the Georgian government, journals, scientific articles, personal studies, research findings from local and international organizations, statistical data, and online resources.

The study employs the following research methods:

- *Theoretical Research*: The primary method of the study involves observing and analyzing theories and studies found in global literature. By examining practical examples of applying these conclusions, the study determines the impact of corporate culture on international business management.
- *Empirical Research*: Following the theoretical analysis, the study examines the organizational structure of a foreign company. This empirical research serves to validate the conclusions drawn in the paper.
- *Logical Method*: Based on the data obtained from theoretical and empirical research, the study uses logical methods to summarize the findings and derive final conclusions, which are presented in the concluding section of the paper.

4. Findings

At the current stage of development, innovative activity is the main factor in production development and raising competitiveness. This problem is particularly acute for the economies of developing countries, because they must not only maintain their current position, but also conquer and become stronger. In Georgia, innovative activity is recognized as a strategic priority. The priority directions for creation and implementation of innovations have been developed. In order to stimulate innovative activities, legislative measures were taken and the Law on Innovations was adopted (Law on Innovations of Georgia, 2016). Also, in 2016, the first technological park in Georgia was created in Okrokana to support innovation. It was built by the Innovation and Technology Agency of Economy and Sustainable Development LLC. The main goal of the technology park was to increase knowledge-based small and medium-sized enterprises and their development. (Kvirikashvili, 2016)

Despite a number of successful projects, the level of innovative development in Georgia is still quite low. Compared to 2019, the situation worsens, in 1920, only three of the 7 indices for upper-middle income countries met the growth rate. These indices are: institutions, human capital and market environment, which were evaluated above the average of these countries. As for the other 4 categories: infrastructure, level of business development, knowledge and technologies, and creativity were evaluated with below average scores. (Dutta & Lanvin, 2020)

As for the analysis of the GII of 2022-23 according to categories, it is given in Table 1. (Information, 2024)

Georgia in the GII rating (2019-2023) looks like this: 2019 - 48th place; 2020-2021 – 63 rd place; 2022 – 74 th place; 2023 - 65th place; As we can see, the results significantly worsened after the pandemic, in addition, methodological changes of the GII took place.

Table no. 1. Global Innovation Index, Georgia 2022-2023 YY

	2022 rating	2023 rating	Change
Institutions	30	25	+5
Level of business development	64	58	+6
Human capital and research	70	69	+1
Market environment	72	77	-5
Knowledge and technologies	75	72	+3
Infrastructure	83	80	+3
Creative products	86	81	+5

Source: (Information, 2024)

Organizational culture determines the concern for the welfare of employees, as well as the behavior of employees and the characteristics of their interaction.

Organizational culture has been defined by many scholars in different ways. The term "organizational culture" has been used since the 18th century, although the development of concepts around it was unsystematic during this period. Many scientists, including E.Schein, M. Ellveson, and others, played a major role in the development and further development of this concept. (M. Ellveson, 2005). In the 1980s, the term "organizational culture" became a subject of active discussion for scientists and various types of organizations. He became famous in the 1990s. The term "organizational culture" was used by the managers, sociologists and various scientists of the time to describe the character and social system of the company, which included shared norms of values, management strategies, interdependence of personnel, their beliefs and habits, work environment, etc.

According to Professor K. Cacciattolo of the University of Malta, there are two approaches. One - interpretation method, according to the environment in the company, second - structural method, focuses on the structure of positions in the organization. (Cacciattolo, 2014)

Scientist Diana Pessy, in her book - "Organizational culture: types and transformations", formulates her opinion and believes that organizational culture originates from the psychology and sociology of personnel, although she considers the work mode to be the main component of the formation of organizational culture. (Pheysey, 2003)

To describe the levels of organizational culture, we will rely on Schein's three-level structure. E. Schein considers organizational culture as a social force that is mostly invisible, but very powerful.(Schein, 2004)

- ✓ The first level is the level of behavior and artifacts, which is manifested in the arrangement of the work environment, technologies, people's dressing style, attitudes and behaviors.
- ✓ The second level - the values recognized by the organization largely determine the behavior;
- ✓ The third level - views and representations.

According to Shane, to truly understand culture, we must go to its deepest layer, the third layer.

The characteristics of organizational culture, which explain the essence of organizational culture, are: consideration of risks during innovation; Focus on details and results; Human resource orientation, competitiveness, sustainable development (Schein, 2004). Evaluating an organization with low or high indicators of these qualities gives us a picture of its culture and a basis for how employees see the organization, how things are done and how they are expected to behave. It is the different levels of these dimensions that lead to sharp differences between companies.

Both functional and dysfunctional aspects of organizational culture are presented in the work. Culture has a defining role: it distinguishes one company from another, it creates an identity for company members, it generates commitment to a larger scale than individual, self-interest, it contributes to the stability of the social system; It is a kind of social glue that unites the organization with standards that employees adhere to and share with each other; It is a control mechanism that shapes and manages employees' behaviors and attitudes, and finally, it creates the rules of the game; organizational climate.

A positive work environment is directly related to customer satisfaction and, ultimately, to the company's financial condition.

Although organizational culture has numerous functional aspects, we should not ignore the impeding aspects of culture, especially strong culture, on organizational effectiveness. These are:

- Institutionalization;
- Barriers to change;
- Barriers to diversity;
- Barriers to merging companies.

It is obvious that organizational culture is an important mechanism of organization management. When studying it, we should take into account the fact that it is influenced by national culture and its peculiarities. Just as nations differ from each other in terms of cultural data, organizations also have their own unique characteristics.

One of the most popular typologies of organizational culture K. Cameron and R. It belongs to Quinn. This typology is based on the "Competing Values Model" they developed. The authors distinguished four groups of criteria that determine the main values of the organization: stability and control; discretion and flexibility; integration and internal focus; Differentiation and external focus. (Cameron & Quinn, 2011).

Four types of culture are known, which are based on different competing values:

- Clan it is distinguished by collaborative (joint) and negotiated, clan management;
- Adhocratic - distinguished by innovative, adaptive and flexible, informal management;
- Hierarchical - is characterized by controlled and constantly hierarchical management;
- Market - competitive and customer-oriented.

As we can see, the essential difference between the listed cultures refers to such basic parameters of the organization as: the principle of leader selection and the decision-making process; The manner of distribution of responsibility and consolidation of functions and the place and role of specific human interests in the organization's activities.

A strong organizational culture requires less effort on the part of management to introduce formal rules and regulations to regulate employee behavior. A strong culture reduces the outflow of human resources, because shared values can give us a sense of inseparable belonging to the organization, guaranteeing the stability of the social system. Such unanimity strengthens organizational commitment, cohesion and accountability and increases the continuity of employee behavior for the benefit of the organization. In case of a weak organizational culture, the activities of the organization are mostly based on personal principles and values.

Organizational culture is the way of life of an organization, which is mainly expressed in the behavior of its employees.

Organizational culture is represented by the basic principles that employees adhere to while performing their duties; in cost indications; in leadership and management style; in the existing communication system; the position, place and importance of employees of the organization; Peculiarities of internal relations of the company; Symbolism, customs, traditions, etc.

Organizational culture is designed to ensure the mobilization of the company's personnel to achieve its goals, instill in employees commitment to accepted values, loyalty to the company's management, and ultimately improve the effectiveness of the organization as a whole. Underestimation of the role of culture hinders the development of the organization. Studies have shown that strengthening organizational culture, which is not accompanied by changes in other working conditions, increases the productivity of employees by 15-25%, and organizations with ambiguous and contradictory cultures are ineffective in market conditions and lose their competitive advantage.

At the same time, a strong culture that is not aligned with the organization's goals and strategy will be a serious obstacle to employee participation in innovation. The concept of innovative activity includes activities aimed at creating innovations, know-how and their further implementation in production and economic activities.

Innovative development is intensive development, that is, more productive, productive and efficient development, when more benefits are obtained from investing the same resource. One of the important issues of innovative development is the correct and effective management of innovative processes, which

is the key to sustainable competitiveness of companies. Management of innovative processes and motivation of behavior is influenced by organizational culture of production.

Innovative activity is based on the concept of innovation, which is "directed changes in the industrial, technical, economic, environmental and social spheres of enterprises, carried out under the influence of new ideas, product models, technologies, etc."

Innovative development of the enterprise is served by discoveries, inventions and rationalization proposals.

Organizational culture helps to stimulate the innovative activity of the company's employees, if it performs the following functions: - creates a unique image of the innovative company; - participates in socialization, directs new employees to creative activities; - shapes employee behavior aimed at achieving the company's goals; - supports values, norms and rules that promote innovation, promotes the introduction and dissemination of innovations; - develops a sense of belonging and unity among the employees of the enterprise, increases loyalty to the enterprise and job satisfaction.

All of the above will have a positive impact on innovative behavior at the next stage of the organization's innovative development:

- 1) Dissemination of positive examples from the experience of employees that demonstrate understanding the importance of innovation;
- 2) Promotion of creative presentation of innovative news;
- 3) Training programs provided for top management and managers, which allow them to identify profitable projects, avoid unprofitable expenses, as well as train prospective employees;
- 4) Clear instructions explaining to employees the prospects of professional and career development as a result of participation in innovative development;
- 5) Discussion of ideas and opinions; If their adherence leads to employee behavior that conflicts with the company's goals and strategy, then such ideas and beliefs must be adjusted;
- 6) Distribution of merit, offering a reward system that takes into account the merits of developers: deadlines, originality, work individually or in groups, etc.;
- 7) The right to take risks and make mistakes. The threat of punishment in case of failure does not stimulate the staff to further innovative activities. Employees should be given a certificate for participation or appreciation for activity to encourage innovative activities.

Researchers from Vietnam Ph. T. Nham, Ph. H. G. Pham, N. Nguyen conducted a study to determine the influence of organizational culture on innovative activities in "N" Vietnamese company. They considered the following dimensions of organizational culture: strategy; obligation; confidence; Behavior that promotes innovation (encouraging risk, generating a large number of new ideas; working environment (methods of interaction and conflict resolution, monitoring work results, etc.), customer orientation (understanding customer needs, improving service); management support (error tolerance, open discussion, provision of equipment and resources); leadership. (Nham, et al., 2014, p. 30)

By analyzing data from 124 respondents, using factor analysis and regression analysis, the researchers found that five of the eight dimensions of organizational culture: management support, strategy, work environment, customer orientation, and leadership have a positive impact on innovation performance. The three remaining factors, including loyalty, trust and behavior that promotes innovation, did not show a statistically reliable relationship with any type of innovative activity of employees, but with the existing rules of the enterprise, organizational culture.) It can be noted that in this case innovation is promoted not so much by employees characteristics, but also the rules and organizational culture in the enterprise. (Nham, et al., 2014, pp. 34-35).

Thus, organizational culture is an important factor affecting the innovative activity of the enterprise. It can both encourage innovative behavior of employees and eliminate any deviations from accepted standards in the organization.

5. Conclusions

The role of innovation-oriented organizational culture is that it forms the innovative behavior of employees as a natural and necessary condition for the development of the organization. Moreover, such a culture can be formed with the active help of the organization's management. Based on the theoretical study of the issue and the conducted research, we conclude that in the era of globalization, organizational culture has an important place in innovative activities. In the company's innovative activity, it is an important variable that determines a specific way of solving problems and conflicting issues, which is necessary for the integrity, success and development of the organization.

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Section IV

Marketing – Management

The Influence of Social Support on Employees' Well-being

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Abstract

The importance of social support in the workplace has been receiving more attention, particularly given its positive impact on employees' health, workers' well-being, and job satisfaction. This article explores how support from colleagues and managers influences these critical outcomes. The study uses an artificial neural network model, specifically the multilayer perceptron, to examine the connections between social support and employee health, well-being, and satisfaction. Findings show a strong, positive relationship between social support and physical and mental well-being, underscoring the pivotal role of supportive workplace relationships in boosting employee satisfaction and overall well-being. These results highlight the importance of creating a supportive and inclusive workplace to improve employee outcomes.

Key words: social support, employees' health, well-being, employees' satisfaction

J.E.L. classification: O15, O33

1. Introduction

In recent years, social support in the workplace has become recognized as a vital contributor to employee health, well-being, and satisfaction. Organizations are increasingly aware that social dynamics—like relationships with colleagues and supervisors—significantly shape employee experiences, affecting their performance, motivation, and likelihood to stay with the organization (Bocean, 2007, 2011). Workplace support can manifest in various forms, including emotional encouragement, instrumental assistance, and informational guidance (Vărzaru and Vărzaru, 2015a,b). These elements form the foundation of a positive workplace environment, fostering employees' sense of belonging, security, and purpose.

The present study aims to fill this gap by investigating the influence of social support on employees' health, workers well-being, and job satisfaction. The empirical model captures the nuanced relationships between various dimensions of social support and employee outcomes. This method allows for a detailed examination of how different forms of social support contribute to these outcomes, providing a deeper understanding of the factors that enhance or diminish employee well-being.

In doing so, this paper contributes to the growing body of literature on workplace well-being by offering empirical insights into how social dynamics within organizations shape employee experiences. By using advanced analytical tools, we also push the boundaries of traditional research methodologies, offering a novel perspective on the role of workplace support. The findings of this study have important implications for both research and practice, particularly in designing interventions and policies that promote supportive work environments and enhance employee outcomes.

2. Theoretical background

Health and well-being are core components of an individual's overall life quality, and their importance is increased in the work environment where employees spend a significant portion of their time. Working conditions commonly impact physical health, while job satisfaction, stress levels, and social interactions often influence psychological well-being. Numerous studies have shown that positive social support can buffer against the harmful effects of workplace stress and contribute to better overall health (LaMontagne et al., 2007; Ganster & Rosen, 2013). In contrast, lacking support or negative social interactions may increase stress, burnout, and lower job satisfaction (Parkyn and Wall, 2020).

Job satisfaction, often a critical predictor of employee retention and organizational productivity, is directly linked to social support (Bocean, 2007; Sitnikov and Bocean, 2010, 2013; Boxall and Purcell, 2022). This relationship suggests that creating an environment where social support thrives should be a priority for organizations aiming to optimize both employee well-being and business outcomes (Vărzaru and Vărzaru, 2013a,b, 2016; Ganster and Rosen, 2013; Vărzaru et al., 2013).

Despite the established importance of social support in various domains of life, its specific role in enhancing well-being and satisfaction has received limited attention in empirical research. While several studies have explored the individual impacts of social support on health (Wilton, 2022) and job satisfaction (Torrington et al., 2014), few have examined the interconnectedness of these factors through the lens of advanced analytical methods such as artificial neural networks.

The role of social support in enhancing employee health and well-being has been well documented in the literature. LaMontagne et al. (2007) highlighted the protective effect of social support against workplace stress, emphasizing that supportive relationships can mitigate the psychological toll of demanding work environments. Ganster and Rosen (2013) similarly argue that social interactions at work serve as a critical buffer, reducing the negative impacts of job stress on physical and mental health. Furthermore, Boxall and Purcell (2022) note that employee satisfaction is closely tied to supportive relationships with supervisors and colleagues, underlining the importance of a positive social environment for overall well-being.

Workplace social support is often linked to better employee outcomes, such as lower stress, improved health, and greater job satisfaction. Parkyn and Wall (2020) found that robust social support systems in the workplace can reduce burnout risk, especially in high-stress jobs. Torrington et al. (2014) add that positive social interactions and a sense of belonging within teams are essential for motivating and engaging employees, ultimately leading to higher satisfaction (Bocean et al., 2021, 2023).

Studies also show that social support affects more than just job satisfaction. Wilkinson (2022) observes that social networks at work are essential for psychological well-being, especially during organizational change or uncertainty. This buffering effect against adverse mental health outcomes is also noted by Ganster and Rosen (2013), who found that employees with higher levels of workplace support manage stress more effectively and are less prone to adverse psychological effects. There is also a strong connection between social support and physical health. Wilton (2022) states that a supportive workplace can improve employees' physical health by reducing stress-related illnesses and absenteeism. This link is particularly important in high-stress environments, where a supportive atmosphere can help mitigate health risks. LaMontagne et al. (2007) further highlight that supportive relationships with coworkers and supervisors do not improve mental well-being or improve.

3. Research methodology

This study utilizes a quantitative research design. The data were analyzed using artificial neural networks, specifically the multilayer perceptron model, to examine the relationships between social support and employee outcomes (Nicolescu and Vărzaru, 2020). The MLP model was chosen due to its ability to model complex relationships and identify both direct and indirect effects between variables (Vărzaru, 2022a,b,c,d; Rotea et al., 2023).

Data research was collected from a sample of employees across various organizations. Participants were surveyed using a structured questionnaire, which included items designed to measure social support, health, well-being, and job satisfaction (Table no. 1).

The paper hypothesizes that improving social support leads to better health outcomes, higher well-being, and enhanced job satisfaction. The performance of the MLP model was evaluated using accuracy measures and the interpretation of normalized importance scores. The results were validated through multiple iterations to ensure consistency and reliability.

Table no. 1 Selected variables

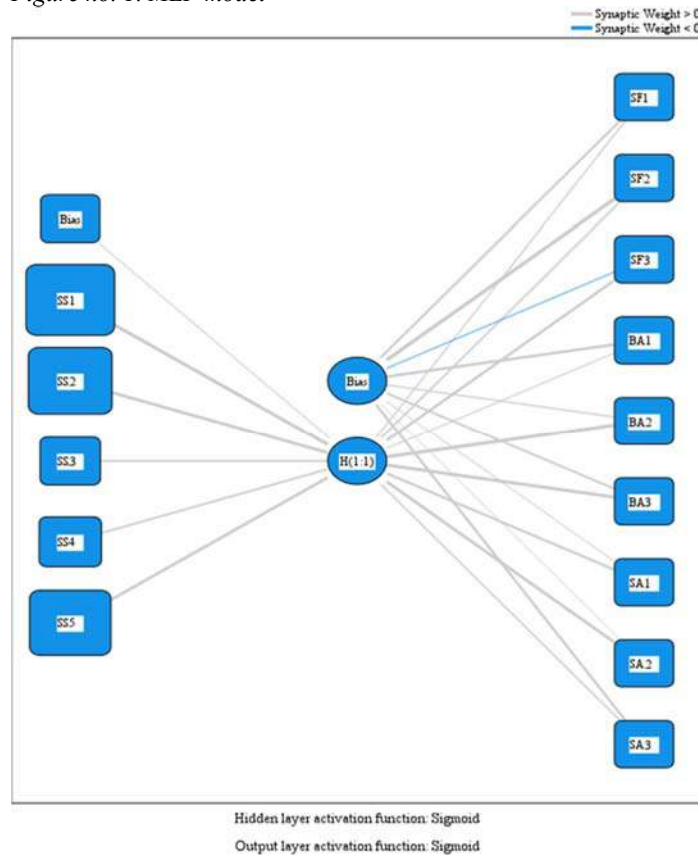
Input variables	Output variables
Support from colleagues (SS1)	Perceived health satisfaction (SF1)
Support from management (SS2)	Commitment to illness prevention for self and others (SF2)
The ability to obtain external assistance (SS3)	Perception of workplace safety (SF3)
A sense of belonging to the organization (SS4)	General well-being (BA1)
Friendships in the workplace (SS5)	Sense of purpose in professional activities (BA2)
	Work-related pride (BA3)
	Job satisfaction (SA1)
	Career advancement satisfaction (SA2)
	Empowerment in decision-making (SA3)

Source: authors' design

4. Findings

The MLP model includes two layers with input (SS1-SS5) and output variables (SF1-SF3, BA1-BA3, SA1-SA3), between which an intermediate layer activated by a sigmoid function is interposed. Figure no. 1 presents the MLP model.

Figure no. 1. MLP model



Source: authors' design

Table no. 2 presents the model values.

Table no. 2 MLP model parameters

Predictor		Predicted										Normalized Importance
		Hidden Layer 1	Output Layer									
			H(1:1)	SF1	SF2	SF3	BA1	BA2	BA3	SA1	SA2	
Input Layer	(Bias)	0.874										
	SS1	1.553										100.0%
	SS2	1.536										91.5%
	SS3	1.074										52.1%
	SS4	1.094										55.4%
	SS5	1.428										87.6%
Hidden Layer 1	(Bias)		1.216	1.640	-0.317	1.424	0.976	1.118	0.832	0.049	1.334	
	H(1:1)		0.893	1.040	1.355	0.878	1.556	1.546	1.311	1.470	0.994	

Source: elaborated by the authors using data processed with SPSS v.27

The MLP model reveals that employee social support from colleagues and managers improves employees' health, workers' well-being, and job satisfaction. In the hidden layer, positive values predominate, reflecting the favorable influence of social support on health, well-being, and satisfaction. The values associated with physical health (SF1-SF3) are relatively high, ranging from 0.893 to 1.335, indicating a clear positive relationship between social support and employee health. Well-being (BA1-BA3) is also strongly influenced, with values ranging from 0.878 to 1.556, showing that social support enhances psychological well-being. Employee satisfaction (SA1-SA3) is also positively influenced, with recorded values ranging from 0.994 to 1.470, highlighting the importance of interactions and social support in increasing workplace satisfaction.

Thus, this model emphasizes the importance of social support in the workplace, particularly concerning the sense of belonging and support from colleagues and managers. These forms of support directly contribute to improving physical and mental health, overall well-being, and employee satisfaction, with a particular focus on the role of organizational belonging. The social support variables positively impact health, well-being, and employee satisfaction, underscoring the importance of a positive and supportive environment and highlighting the beneficial influence of harmonious relationships on psychological well-being and employee satisfaction. The validation of the paper hypothesis is supported by these results: harmonious social relationships at work, especially those based on mutual support, profoundly affect employee well-being and satisfaction.

5. Conclusions

The findings of this study highlight the significant role that social support plays in enhancing employees' health, well-being, and job satisfaction. The analysis conducted using artificial neural networks (MLP model) reveals that various forms of social support - whether from colleagues, managers, external sources, or through a sense of belonging to the organization - have a measurable and positive impact on key employee outcomes.

Support from colleagues (SS1) and managers (SS2) emerged as particularly influential, demonstrating that a work environment where employees feel supported by their peers and supervisors leads to improved physical health, psychological well-being, and job satisfaction. This aligns with existing literature, which consistently shows the buffering effect of social support against workplace stress and burnout. The ability to obtain external assistance (SS3) also plays a crucial role, particularly in situations where employees face challenges that extend beyond the internal resources of their organization. Furthermore, the sense of belonging to the organization (SS4) was a critical predictor of well-being, suggesting that employees who feel integrated into the organizational culture experience higher levels of psychological comfort and commitment. Workplace friendships (SS5) significantly contribute to employee satisfaction, indicating that positive interpersonal relationships enhance job enjoyment and foster a more supportive and cohesive work environment.

The study underscores the importance of fostering a workplace culture that promotes social support at multiple levels. Organizations should prioritize initiatives that enhance peer and managerial support, cultivate a sense of belonging, and encourage strong workplace relationships. Such efforts can substantially improve employee health, well-being, and satisfaction, ultimately contributing to higher productivity and organizational success. The results also validate Hypothesis H3, affirming that harmonious social relationships in the workplace, especially those based on mutual support, profoundly affect employee outcomes.

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The Mobile Revolution: Understanding the Impact of Mobile Apps on Consumer Behavior

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Abstract

Mobile applications have transformed the landscape of consumer behavior, embedding themselves as critical tools in modern marketing strategies. This study explores the intersection of mobile app marketing and consumer experiences, examining its effects on decision-making processes and brand engagement. Through a comprehensive review of the literature, we analyze the enablers and barriers presented by mobile platforms, highlighting their role in shaping the customer journey. Insights derived from this investigation provide actionable recommendations for marketers and app developers to enhance user satisfaction and trust, ensuring sustained engagement in an increasingly digital economy.

Key words: Mobile marketing, consumer behavior, customer journey, personalization, mobile apps.

J.E.L. classification: M31, M37

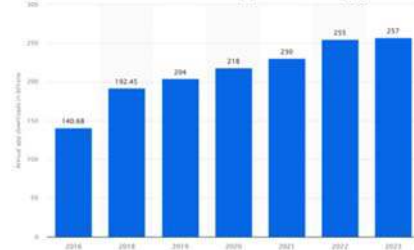
1. Introduction

The rapid proliferation of mobile applications has revolutionized consumer behavior and reshaped the marketing landscape. With over 6.3 billion smartphone users worldwide, mobile apps have become integral to daily life, facilitating shopping, communication, and entertainment. Mobile applications have disrupted traditional marketing paradigms, serving as versatile tools that influence consumer behaviors at multiple levels. Whether through tailored advertisements, interactive interfaces, or convenience-enhancing features, apps have become indispensable for both consumers and businesses. This paper seeks to unpack the multifaceted role of mobile apps, not only as tools for engagement but as platforms that redefine customer relationships in an increasingly digital world. Drawing on theoretical models like TAM (Technology Acceptance Model) and empirical data, we aim to bridge the gap between technological advancements and practical marketing applications.

2. Literature review

The advent of mobile applications has ushered in a new era of consumer engagement, fundamentally altering traditional marketing paradigms. The integration of advanced technologies such as Artificial Intelligence (AI), Augmented Reality (AR), and the Internet of Things (IoT) has enabled unprecedented levels of personalization and interaction. These innovations have expanded the scope of mobile marketing, providing businesses with robust tools to influence consumer behavior.

Figure no. 1. Number of mobile apps downloaded worldwide between 2016 and 2023



Source : (Statista, 2024)

Kotler's concept of 'Marketing 5.0' frames this evolution as the fusion of technology and humanity, leveraging AI and big data to deliver tailored experiences. For instance, AI-powered recommendation systems in apps like Amazon and Netflix analyze user data to suggest personalized content, boosting engagement and retention. These applications exemplify how machine learning and predictive analytics are central to modern mobile marketing strategies.

Augmented Reality (AR) has emerged as a transformative tool in retail. Apps such as IKEA's Place and Sephora's Virtual Artist enable consumers to visualize products within their environments, bridging the gap between online and offline experiences. Studies have shown that these immersive features significantly enhance purchase confidence and reduce product returns. By offering virtual try-ons or visual previews, brands can foster deeper consumer trust.

Another critical area of exploration is the impact of mobile apps on the consumer decision-making process. Traditional decision models are being reshaped by the immediacy and convenience offered by mobile platforms. Mobile apps influence each stage of the consumer journey—from pre-purchase research facilitated by review aggregators to real-time purchase incentives like flash sales. The role of post-purchase engagement is equally significant, with apps providing support and fostering loyalty.

Figure no. 2. Key areas for achieving sustainable competitive advantage in the mobile shopping era



Source : (Faulds et al., 2018)

The Technology Acceptance Model (TAM), proposed by Davis (1989), remains a cornerstone for understanding the adoption of mobile apps. The model posits that perceived usefulness and ease of use are primary determinants of user acceptance. This framework has been adapted to explore mobile app usage, highlighting the importance of intuitive interfaces and functional benefits in driving user engagement. Apps that successfully address these factors tend to see higher adoption rates.

Despite the myriad benefits, mobile marketing faces challenges, particularly around privacy and security. The collection and analysis of user data, while enabling personalization, raise concerns about data protection. As Haleem et al. (2022) point out, transparency in data practices is critical for maintaining consumer trust. Moreover, the reliance on algorithms introduces the risk of bias, which can lead to ethical dilemmas and potential regulatory scrutiny.

Gamification within mobile apps has also garnered significant attention in the literature. By incorporating game-like elements, brands can drive user engagement and loyalty. For instance, fitness apps such as Strava and Nike Run Club utilize gamified challenges to motivate users, aligning brand interaction with consumer goals. This approach not only enhances user satisfaction but also creates emotional ties to the brand.

Mobile apps also serve as a critical interface for experiential marketing. Platforms like TikTok and Instagram provide creative avenues for brand storytelling, blending entertainment with advertising. These apps cater to younger demographics, offering a blend of social interaction and shopping opportunities. The convergence of content and commerce within these platforms underscores their dual role as marketing tools and sales channels.

The integration of IoT with mobile apps further exemplifies their transformative potential. Smart home apps, wearable technology, and health monitoring platforms illustrate the broad applicability of IoT-enabled apps. By providing real-time data and control, these applications enhance user convenience and drive engagement. For example, wearable health devices synced with mobile apps empower users to track fitness goals, fostering a sense of agency and loyalty.

3. Research methodology

This study adopts a qualitative approach, synthesizing existing literature and empirical studies to understand the impact of mobile apps on consumer behavior. Key sources include peer-reviewed journals, industry reports, and case studies, enabling a multidimensional analysis of mobile marketing dynamics.

Additionally, specific industry examples, such as the use of AI in Uber's ride optimization algorithms and the effectiveness of gamification strategies in fitness apps like Strava, were explored. This methodological diversity enables a nuanced understanding of how mobile apps influence decision-making.

4. Findings

Mobile apps significantly impact the consumer decision-making process, offering convenience, personalization, and real-time engagement. Applications like Sephora and IKEA exemplify the use of AR for enhanced shopping experiences, while AI-driven tools provide predictive analytics to anticipate consumer needs.

1. Impact on Pre-Purchase Behaviors

Mobile apps facilitate information access during the pre-purchase phase, enabling consumers to compare prices, read reviews, and explore product features. For example, Amazon's mobile platform uses AI to highlight top-rated products based on consumer preferences.

2. Influence on Purchase Decisions

Apps like Uber Eats simplify the purchase process through streamlined interfaces and one-click payment options. These conveniences, coupled with personalized recommendations, increase conversion rates. Yet, research indicates that over-personalization can lead to decision fatigue.

3. Post-Purchase Engagement

Post-purchase interactions via apps are critical for fostering loyalty. Features like tracking systems, feedback forms, and loyalty programs ensure continuous consumer engagement. Starbucks' rewards app exemplifies how gamified elements can drive repeat purchases.

However, the findings also reveal challenges. Privacy concerns and trust deficits, especially in data-sensitive applications, hinder broader adoption. Addressing these issues through transparent practices and robust data security measures is essential.

5. Conclusions

Mobile apps are indispensable tools in contemporary marketing, but their success hinges on strategic implementation. By leveraging AI, AR/VR, and robust data analytics, companies can craft compelling consumer experiences that foster loyalty and trust. Nonetheless, the need for ethical

considerations, especially in privacy and data security, remains paramount.

Future research should investigate emerging trends such as blockchain integration in app security and the role of 5G technology in enhancing real-time engagement. Marketers and app developers must collaborate to create inclusive and innovative solutions that address consumer concerns while maximizing technological potential.

Mobile applications are at the heart of the digital transformation in consumer behavior. Central to their success is the integration of advanced technologies such as Artificial Intelligence (AI), Augmented Reality (AR), Virtual Reality (VR), and the Internet of Things (IoT). These technologies not only enhance user experiences but also allow marketers to gain deeper insights into consumer preferences and behaviors. For example, IoT-enabled mobile apps can provide real-time data, helping businesses tailor their offerings dynamically.

Several studies underscore the transformative role of mobile apps in marketing. Doshchanova et al. (2024) discuss how AI-driven personalization in mobile apps enhances user engagement by delivering content and recommendations that align with individual preferences. Kotler (2021) refers to this as 'segments of one,' a strategy that replaces traditional market segmentation with highly individualized consumer targeting. Apps such as Spotify and Netflix employ predictive analytics to anticipate user needs, thereby maintaining high retention rates.

In the realm of retail, mobile applications redefine the customer journey by integrating physical and digital shopping experiences. Apps like IKEA's Place and Sephora's Virtual Artist use AR to let consumers visualize products in their real-world environments. These tools reduce purchase hesitations and foster greater consumer confidence. Similarly, mobile commerce apps, or m-commerce, streamline the buying process with features such as one-click payments and real-time customer support.

Theoretical frameworks, such as the Technology Acceptance Model (TAM), provide a basis for understanding consumer adoption of mobile apps. According to Davis (1989), perceived usefulness and ease of use are critical in determining whether users adopt a particular technology. In the context of mobile apps, this model highlights the importance of intuitive design and practical benefits.

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Organizational Change Management the Impact of Transformational Leadership on Change Efficiency

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Abstract

Organizational change management is critical to the adaptation and long-term success of organizations. Transformational leadership plays a crucial role in this context, having a significant impact on the effectiveness of implementing changes. The present study examines how the dimensions of transformational leadership—idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration—contribute to the success of organizational change. The research was conducted on a sample of 300 managers from various industries, using the Multifactor Leadership Questionnaire (MLQ) to assess the correlations between leadership style and change effectiveness. The results indicate that idealized influence and inspirational motivation are the most influential dimensions of transformational leadership in increasing the effectiveness of organizational changes. The study provides recommendations for developing transformational leadership skills and improving change management.

Key words: transformational leadership, change management, organizational change effectiveness, leadership dimensions, strategic changes

J.E.L. classification: M12, M54, O15, L2

1. Introduction

In a constantly changing business environment, organizations face major challenges that require rapid and effective adaptation. Organizational changes can range from strategic and technological adjustments to profound cultural changes. The effectiveness of implementing these changes is often influenced by leadership style.

Transformational leadership, known for its ability to inspire and motivate employees, has proven to be crucial in the success of organizational change.

Transformational leadership, according to the theory developed by Burns (1978) and extended by Bass (1985), focuses on creating a compelling vision and stimulating employees to exceed expectations. In this context, it is essential to understand how the dimensions of transformational leadership influence the effectiveness of organizational changes.

This study has three main objectives:

1. Evaluation of the dimensions of transformational leadership: Analyzing the impact of each dimension of transformational leadership on the effectiveness of organizational changes.
2. Analysis of correlations: Identification of correlations between the dimensions of transformational leadership and the success of implemented changes.
3. Formulation of recommendations: Development of recommendations for organizations regarding the optimization of change management through transformational leadership.

Understanding the role of transformational leadership in the success of organizational changes is crucial for the development of effective change strategies. The study contributes to the existing literature by providing an empirical perspective on the relationship between transformational leadership and change effectiveness.

The obtained results can guide organizations in the development of leadership programs and in the implementation of organizational changes.

2. Theoretical background

2.1. Transformational leadership

Transformational leadership is characterized by:

- Idealized Influence: Transformational leaders act as role models, having principles and values that inspire respect and loyalty.
- Inspirational Motivation: Creating an ambitious vision that motivates employees to actively engage in achieving goals.
- Intellectual Stimulation: Encouraging innovation and critical thinking for problem solving.
- Individualized Consideration: Providing personalized support and attention to employees, adapting to each individual's needs and aspirations.

James MacGregor Burns (1978) introduced the concept of transformational leadership, emphasizing the importance of leaders who do not just manage, but inspire and motivate employees. Bernard Bass (1985) extended Burns' theory by developing the Multifactor Leadership Questionnaire (MLQ) to assess the dimensions of transformational leadership and their impact on organizational performance.

Bass & Riggio (2016) highlighted that transformational leaders improve organizational performance by creating a clear and inspiring vision and motivating employees to achieve ambitious goals. Podsakoff et al. (2016) demonstrated that transformational leader behaviors are associated with better employee satisfaction and increased team performance.

2.2. Organizational changes

Organizational changes are complex processes that involve significant changes in the structure, strategy or culture of an organization. These changes may include:

- Strategic Changes: Changes in the organization's long-term goals and direction.
- Technological Changes: The implementation of new technologies that affect processes and operations.
- Organizational Changes: Changes in organizational structure or internal processes.
- Cultural Changes: Changes in the organization's values and norms.

The success of these changes is often related to how they are managed and the leadership style adopted.

Garcia-Morales et al. (2018) showed that transformational leadership contributes to the success of changes by creating an organizational climate favorable to innovation and collaboration. Wang et al. (2020) conducted a meta-analysis of existing studies, confirming that transformational leadership has a significant impact on the effectiveness of organizational change, improving adaptability and organizational performance.

Neagu (2017) studied transformational leadership in the Romanian private sector, highlighting its positive impact on organizational changes.

Bibu & Sala (2019) analyzed transformational leadership in educational institutions in Romania, emphasizing the importance of this leadership style in the implementation of educational changes.

2.3. The need for the study

Although there is much research on transformational leadership, there are few studies that explore in detail its impact on the effectiveness of organizational change. This study addresses this gap by providing an empirical assessment of how the dimensions of transformational leadership influence the success of organizational change and provides valuable insights for practitioners in the field.

3. Research methodology

The first objective of the study is to examine the impact of each dimension of transformational leadership on the effectiveness of organizational change. It will look at how idealized influence, inspirational motivation, intellectual stimulation and individualized consideration contribute to successful change.

The second objective is to identify correlations between the behaviors of transformational leaders and the success of organizational change. The analysis will include assessing the relationships between the variables and identifying the dimensions with the greatest impact on the effectiveness of the changes.

Finally, the objective is to develop practical recommendations for organizations regarding the implementation and development of transformational leadership. Recommendations will be based on the results of the study and provide guidelines for improving change management.

The Multifactor Leadership Questionnaire (MLQ), developed by Bass & Avolio (2015), is used to assess the dimensions of transformational leadership. The MLQ includes items that measure idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration. The questionnaire is available for purchase on Mind Garden and was used to collect data from managers.

Data was collected through an online survey distributed to 300 managers from various industries. The questionnaire was structured based on a five-point Likert model, which allowed the evaluation of each dimension of transformational leadership and their impact on the effectiveness of organizational changes.

Data were analyzed using multiple linear regression to examine the impact of each dimension of transformational leadership on organizational change effectiveness.

Correlation analysis was used to determine the relationships between the variables and to identify the dimensions with the greatest impact on the success of the changes.

4. Findings

4.1. The correlation between the components of transformational leadership and the effectiveness of change

The results of the correlation analysis revealed the following significant relationships between the dimensions of transformational leadership and the effectiveness of organizational changes:

Table no. 1 The dimensions of transformational leadership and the effectiveness of organizational change

Leadership component	Correlation coefficient	Statistical significance (p)
Idealized influence	0.68	< 0.01
Inspirational motivation	0.72	< 0.01
Intellectual stimulation	0.60	< 0.05
Individualized consideration	0.66	< 0.01

Source: Own analysis based on data collected through the Multifactor Leadership Questionnaire (MLQ) (Bass & Avolio, 2015)

4.2. Success rates of organizational change according to leadership style

The results showed that transformational leadership is associated with the highest success rates of organizational change compared to other leadership styles:

Table no. 2. Analysis of data on organizational changes

Leadership style	Change success rate (%)
Transformational leadership	78%
Transactional leadership	55%
Laissez-faire leadership	38%

Source: Own analysis based on data collected from the survey conducted with managers.

4.3. Interpretation of results

The results of the study clearly indicate that idealized influence and inspirational motivation are the strongest predictors of organizational change effectiveness.

These two dimensions of transformational leadership not only demonstrated a significant correlation with change success, but also emphasized the crucial role leaders play in creating an environment conducive to change and actively engaging employees.

● **Idealized influence as a key predictor**

Idealized influence refers to the ability of leaders to be perceived as role models and sources of inspiration.

Leaders who exhibit idealized influence demonstrate values and principles that are aligned with the organizational vision and earn the respect and trust of employees. These leaders are often considered worthy of following because of their integrity and commitment to organizational goals.

The impact on the efficiency of the changes:

● **Creating a favorable environment:** Idealized influence helps to create an organizational climate favorable to change by setting clear standards and demonstrating a positive attitude towards change.

Employees who respect and are inspired by leaders' behaviors are more likely to accept change and engage in the implementation process.

● **Motivating and engaging employees:** Leaders who exhibit idealized influence succeed in uniting employees around a shared vision and cultivating a sense of ownership and commitment to the organization's goals.

This increased involvement directly favors the success of organizational changes, thus facilitating adaptation to transitions and overcoming challenges associated with the change process.

● **Inspirational motivation as a success factor**

Inspirational motivation refers to the ability of leaders to motivate employees by setting challenging goals and communicating an enthusiastic and inspiring vision.

Leaders who use this dimension are able to instill enthusiasm and energy in teams, motivating employees to exceed expectations and actively engage in the change process.

The impact on the efficiency of the changes:

● **Increase Commitment:** Inspirational motivation helps increase employee commitment to change by creating an engaging and challenging vision that stimulates the desire to contribute to organizational success.

Employees who are inspirationally motivated are more willing to invest in implementing change and overcoming challenges.

● **Reducing Resistance to Change:** Inspirational motivation helps to reduce resistance to change by presenting changes as positive opportunities and by stimulating an open and receptive attitude.

Employees who receive inspiration from their leaders are more inclined to adopt a proactive attitude and contribute effectively to implementing change.

● **Transformational leadership compared to other leadership styles**

The study confirmed that transformational leadership proves to be more effective in facilitating organizational change compared to transactional and laissez-faire styles.

This is due to the distinctive characteristics of transformational leadership that enable leaders to influence and motivate employees in a way that promotes change.

● **Transactional Leadership:** This leadership style focuses on using rewards and sanctions to control performance and implement change. While it may provide stability and achievement of short-term goals, it fails to inspire employees or promote a long-term strategic vision.

In organizational change, transactional leadership may have limitations in its ability to foster employee commitment and enthusiasm.

● **Laissez-Faire Leadership:** Laissez-faire leadership is characterized by a passive approach, where leaders avoid being actively involved in organizational processes and decision-making. This style can lead to a lack of direction and decreased employee engagement, which can negatively affect the effectiveness of change.

Laissez-faire leaders fail to provide the guidance and support needed to implement change, which can lead to resistance and difficulty in achieving change goals.

The results of the study emphasize that idealized influence and inspirational motivation are essential dimensions of transformational leadership that significantly contribute to the success of organizational change.

These dimensions facilitate the creation of an environment conducive to change and engage employees in a way that promotes the adoption and effective implementation of change.

Transformational leadership, through its inspirational and motivational nature, proves to be superior to other leadership styles in managing and facilitating organizational change, providing a holistic and strategic approach that contributes to the long-term success of organizations.

5. Discussions and interpretations

The study confirms the importance of transformational leadership in facilitating organizational change. Transformational leaders, through idealized influence and inspirational motivation, are able to create a climate of trust and commitment, essential for successful change. Intellectual stimulation and individualized consideration also contribute to employee adaptability and the effectiveness of change implementation.

The results of the study are consistent with previous research suggesting that transformational leadership is associated with superior performance and success in organizational change (Garcia-Morales et al., 2018; Wang et al., 2020).

Compared to transactional and laissez-faire styles, transformational leadership is found to be more effective in motivating employees and facilitating change.

The study has some limitations, including the sample size and the diversity of industries included. In the future, it would be useful to explore the impact of transformational leadership in more specific contexts and analyze its long-term effects.

Also, future studies could include perspectives from different cultures and regions to assess the generalizability of the results.

6. Conclusions and recommendations

6.1. Conclusions

Transformational leadership proves to be an essential factor for the success of organizational changes. The study clearly highlighted that leaders who adopt this leadership style are able to positively influence employees and facilitate the implementation of changes in an effective manner.

In an organizational context where change is constant and often challenging, the skills and behaviors of transformational leaders are especially valuable.

A fundamental aspect of transformational leadership is the ability to create an inspiring vision.

Transformational leaders develop and communicate a clear and compelling vision for the future of the organization, which helps employees understand and buy into the direction of change.

This vision not only encourages employees to actively engage in the change process, but also gives them a clear sense of direction and purpose.

Research indicates that leaders who inspire and coordinate teams around a collective vision are more effective in managing and implementing organizational change.

Transformational leadership is not just about influencing employees, it also includes supporting their individual development.

Transformational leaders emphasize the personal growth of each team member by providing constructive feedback, mentoring, and professional development opportunities.

This approach not only develops employees' skills, but also contributes significantly to increasing their level of engagement and job satisfaction.

The study showed that individualized consideration, which reflects the leaders' concern for the personal development of employees, is a crucial factor for the success of organizational changes.

The study identified two dimensions of transformational leadership that have a particular impact on the effectiveness of organizational changes:

Transformational leaders who exhibit idealized influence are seen as role models. They demonstrate values and behaviors that inspire trust and respect among employees.

This idealized influence helps create a positive climate for change, where employees are more likely to accept and support change initiatives.

Inspirational motivation is another crucial dimension. Leaders using this dimension are able to motivate employees by setting challenging goals and communicating an enthusiastic vision.

This motivation not only stimulates employees to be actively involved in the change process, but also supports them in overcoming obstacles, keeping their performance at a high level during transitions.

In general, transformational leadership has been shown to be superior to other leadership styles in the context of organizational change.

Transformational leaders not only facilitate change, but also help create an organizational environment that supports and encourages change.

In conclusion, the results of the study underline the importance of transformational leadership in the context of organizational change and confirm that idealized influence and inspirational motivation are essential dimensions that contribute to the success of these changes.

Leaders who embrace these principles and behaviors are better equipped to navigate the complexities and challenges of organizational change, thereby ensuring more effective and sustainable implementation.

6.2. Recommendations for practice

Development of Training Programs: Organizations should invest in the training of transformational leaders, focusing on the development of skills of idealized influence and inspirational motivation.

- Improving communication within the organization is crucial to clarify the vision and reduce the uncertainty associated with the change process.

- Cultivating an organizational culture that supports innovation and collaboration can facilitate effective change implementation.

The study conducted clearly demonstrated that transformational leadership plays an essential role in the effectiveness of organizational changes. Leaders who adopt this leadership style not only inspire and motivate employees, but also contribute to the creation of an organizational climate conducive to change. This finding has significant implications for the future of change management and leader development in organizations.

The results of the study suggest that organizations need to integrate transformational leadership into their change strategies to maximize the effectiveness and success of these changes. Implementing effective transformational leadership is not only limited to training existing leaders, but also involves:

Organizations should develop and implement training programs that focus on developing transformational leadership skills, including idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration.

Regularly evaluating leaders' performance and providing constructive feedback is essential to continuous improvement of leadership style.

Organizations can use assessment tools, such as the Multifactor Leadership Questionnaire (MLQ), to measure the impact of transformational leadership and identify areas for improvement.

To sustain the success of long-term change, organizations must engage in the continuous development of leaders.

This commitment includes:

- Implementing mentoring and coaching programs for emerging leaders can facilitate the development of skills necessary to become effective transformational leaders. Mentors and coaches can provide valuable insights and personalized support, helping to increase leadership skills.

- Effective communication is a crucial aspect of transformational leadership. Organizations should provide trainings to help leaders improve their communication skills in order to convey the organizational vision and motivate employees effectively.

The study suggests that it would be useful to explore the impact of transformational leadership in varied contexts to better understand how this leadership style applies in different industries, cultures and regions:

- Future research could investigate how transformational leadership influences organizational change in different cultures and countries, identifying the necessary adaptations for global success.

- Sector studies can provide a deeper understanding of how transformational leadership manifests and contributes to specific industries such as technology, healthcare, education or the public sector.

To support the success of organizational change, organizations must develop strategies that integrate transformational leadership into all aspects of change management:

- Transformational leaders can play an important role in planning organizational change, helping to develop a clear vision and strategic goals that are accepted and supported by the entire organization.

- Leaders must monitor and adjust change strategies based on feedback and results, ensuring that changes are implemented effectively and that employees are engaged in the change process.

The study highlights the importance of including transformational leadership in organizational policies and practices:

- Organizations should integrate transformational leadership into recruitment and promotion policies, ensuring that selected and promoted leaders have the necessary skills to support organizational change.

- Performance evaluations should include indicators related to transformational leadership skills so that leaders are motivated to develop and apply these skills in their daily activities.

In conclusion, engaging transformational leaders actively in managing organizational change is fundamental to achieving sustainable success.

Organizations that are dedicated to developing leaders and integrating transformational leadership into their strategies will be better able to meet the challenges and capitalize on the opportunities in an ever-changing business environment.

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Performance Management and Organizational Culture: Mutual Influences in Service-Providing Organizations

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Abstract

The paper explores the relationship between performance management and organizational culture in service organizations, aiming to identify how these concepts can be aligned to improve employee performance and customer satisfaction. The study uses a mixed approach, including quantitative (questionnaires) and qualitative (semi-structured interviews and case studies) methods, to analyze the mutual influences between the two concepts.

The results highlight that an organizational culture oriented towards collaboration, innovation and recognition of individual merits stimulates employee performance and adaptability. The research contributes to the specialized literature, offering good practices for managers, such as integrating performance management strategies into organizational culture and investing in continuous professional training.

Limitations include the small sample size in the Romanian service sector, suggesting further expansion to other cross-national comparative studies.

Key words: performance management, organizational culture, service organizations, customer satisfaction, employee performance

J.E.L. classification: M12, M14, L84, D23, O15, J24

1. Introduction

In the context of globalization and increasing competition, service organizations face mounting pressure to enhance their performance. Performance management and organizational culture are two essential factors that can significantly influence the success of organizations in this domain (Armstrong, 2017, p. 25). Human resource performance management is a key concern for organizations, as employees often represent the primary interface with clients and, consequently, a critical determinant of customer satisfaction (Braicu C., Rogozeanu C.L., 2024, p. 25-31).

According to Drucker P. (2015, p. 78), organizations that successfully create a performance-oriented culture can benefit from more motivated and engaged human resources. Similarly, Hofstede (2001) highlights the importance of organizational culture in fostering an environment that supports human resource development and the achievement of organizational goals.

This research focuses on the correlation between performance management and organizational culture in the context of service organizations, with particular emphasis on their reciprocal influences. The study underscores the importance of both methodological approaches and empirical analysis to understand how these two factors interact in the service sector.

The literature review reveals an emphasis on addressing questions such as how organizational culture influences employee performance management in service organizations, to what extent performance management strategies can shape the existing organizational culture, and which practices are most effective in improving employee performance in this sector.

2. Theoretical background. The Importance of Performance Management in Service Organization. The Relationship Between Organizational Culture and Employee Performance

The service sector is distinguished from other sectors by its intangible nature, the simultaneity of production and consumption, and the strong dependence on interactions between providers and clients. In this context, human resource performance plays a crucial role in ensuring customer satisfaction and, consequently, the organization's success. The unique characteristics of this sector have highlighted challenges in evaluating human resource performance, impacting the development of a robust organizational culture.

According to Armstrong (2017, p. 32), in service organizations, employee behavior during client interactions shapes clients' perceptions of service quality. Therefore, performance management becomes a strategic factor in achieving and maximizing competitive advantage.

Braicu C., Rogozeanu C.L. (2024, p. 25-31) state that organizational performance in service organizations is closely tied to employees' interpersonal skills, problem-solving abilities, and responsiveness to client needs. Thus, effective performance management must include continuous competency evaluation and professional development for employees.

- **Impact of Performance on Customer Satisfaction and Employee Retention**

Customer satisfaction is a key indicator of success in service organizations. Kaplan & Norton (2004, p. 67) emphasize that employees' performance in service delivery directly influences customers' perceptions of service quality. Efficient performance management directly enhances customer satisfaction by ensuring a consistent and personalized experience.

Moreover, advanced performance management systems not only increase customer satisfaction but also improve workforce stability by recognizing employee efforts and contributions and offering professional development opportunities. Employee retention is particularly important in the service sector, where high turnover rates can lead to significant knowledge and skill losses.

- **Effective Practices and Tools for Performance Evaluation**

Performance evaluation in service organizations requires tools tailored to the sector's specific characteristics. The literature highlights a mix of quantitative and qualitative indicators to measure human resource performance, such as customer feedback, response times, and problem-resolution rates. Drucker (2015, pp. 85) stresses the importance of setting clear, measurable goals for employees and employing reward systems to motivate superior performance. Methods such as self-assessment and peer evaluation are essential for obtaining a comprehensive picture of performance (Braicu C., Rogozeanu C.L., 2024, p. 25-31).

Organizational culture comprises a set of values, beliefs, and behaviors that influence how employees interact and perform their tasks. Schein (2010, p. 27) classifies organizational culture into power culture, role culture, task culture, and person culture, each impacting employee performance differently. For instance, a task-oriented culture focused on achieving objectives and innovation can boost performance, while a rigid role-oriented culture may stifle creativity and initiative.

Hofstede (2001, p. 85-90) notes that organizational culture typologies influence human resources' attitudes toward teamwork, decision-making, and adaptability to change. In service organizations, a client-oriented organizational culture enhances performance by encouraging employees to provide high-quality services and be more responsive to client needs.

Mediating and Moderating Factors Between Organizational Culture and Performance

Various factors mediate and moderate the relationship between organizational culture and employee performance. Managerial aspects such as leadership style, internal communication, and employee motivation often determine how organizational culture affects performance. For example, a democratic leadership style that fosters employee involvement can amplify the positive impact of an innovation-oriented organizational culture on human resource performance.

Braicu C., Rogozeanu C.L. (2024, p. 25-31) show that in service organizations, flexibility and adaptability are critical factors. These act as mediators, fostering an organizational culture that supports both employees and organizational performance.

Kaplan & Norton (2004, p. 115-118) present a financial services company that implemented a culture focused on continuous improvement, leading to a significant increase in customer satisfaction. This transformation was achieved by aligning individual objectives with organizational values and providing constant feedback to employees, demonstrating how organizational culture influences employee performance in the service sector.

In Romania, recent studies have shown that a culture based on openness and effective communication has improved employee performance and retention, regardless of geographic area or organizational type.

3. Research methodology

The primary objective of this study is to explore the reciprocal influences between performance management and organizational culture in service organizations. The study will incorporate both quantitative analyses (questionnaires) and qualitative analyses (interviews and case studies) to deeply examine the relationships between the variables under investigation.

The research aims to assess how organizational culture impacts employee performance, identify how performance management strategies can influence existing organizational culture, and ultimately propose a series of best practices for improving employee performance in service organizations.

According to Creswell (2014, pp. 31), using a mixed-methods approach enhances data triangulation, thereby increasing the validity of the results obtained.

Data Collection Methods (Questionnaires, Interviews, Case Studies)

1. Questionnaires: Quantitative data will be collected through a structured questionnaire administered to a sample of employees in service organizations. The questionnaires will include closed-ended questions to measure perceptions of performance and organizational culture. Armstrong (2017, p. 112) recommends using questionnaires to obtain standardized and comparable data.

2. Semi-structured Interviews: Interviews will be conducted with managers and employees to gather qualitative data that complement the questionnaire findings. These interviews will explore perceptions regarding the influence of organizational culture on performance.

3. Case Studies: Two service organizations will be selected for detailed case studies to provide concrete examples of the relationship between organizational culture and performance.

Measurement Tools: Scales for Evaluating Performance and Organizational Culture

To measure employee performance, a 5-point Likert scale will be used to evaluate indicators such as productivity, job satisfaction, and engagement. According to Kaplan & Norton (2004, p. 140), such scales provide precise performance measurement and facilitate quantitative analysis.

For organizational culture, a questionnaire based on Denison's Cultural Model (<https://denisonconsulting.com/wp-content/uploads/2019/08/introduction-to-the-denison-model.pdf>) will be utilized, which includes dimensions like employee involvement, consistency, adaptability, and mission.

- Sample, Selection Criteria, and Sample Size

The study will use a sample of 50 employees from service organizations in Romania. Stratified sampling will be employed to ensure representation across different hierarchical levels and departments. According to Saunders et al. (2019, p. 275), this method ensures a sample reflecting the diversity of the studied organizations.

- Data Analysis Procedure (Statistical Analysis, Thematic Analysis)

Quantitative data from the questionnaires will be analyzed using statistical analysis in R to test the relationships between variables and verify the formulated hypotheses. Techniques such as regression analysis and correlation analysis will be applied (Field, 2012, p. 183).

Qualitative data from interviews and case studies will be analyzed using thematic analysis, as outlined by Braun & Clarke (2006, p. 89), to identify recurring themes related to organizational culture and employee performance.

4. Findings

- Presentation and Interpretation of Collected Data

The data collected through questionnaires and interviews will be analyzed to better understand the relationship between performance management and organizational culture in service organizations. Questionnaire responses will be processed using descriptive and inferential statistical analysis, focusing on performance indicators and organizational culture dimensions. According to Field (2012, p. 198-202), descriptive analysis helps identify general trends in the data and compare them with industry standards.

Previous results indicate that employees who perceive organizational culture as collaborative and innovation-oriented tend to score higher in performance. This suggests that a culture supporting collaboration positively impacts performance, aligning with Schein's (2010, p. 43) findings on the importance of participative culture.

Correlation analysis between variables has revealed significant reciprocal influences between organizational culture and performance management. A growth-oriented and developmental organizational culture positively impacts performance, while effective performance management strategies can, in turn, shape organizational culture. Kaplan & Norton (2004, p. 150-152) suggest that performance evaluation practices aligned with organizational culture enhance employee engagement and workplace relationships.

Based on interview results, the study will examine whether employees in organizations with supportive and merit-recognizing cultures are more motivated and engaged in daily activities. This conclusion will indicate whether an organizational culture promoting recognition and professional development drives improved organizational performance.

According to Hofstede (2001, p. 102-106), cultural dimensions such as collectivism and innovation orientation can positively influence employee attitudes toward performance. These findings underscore the importance of aligning performance management strategies with organizational culture to achieve optimal results.

The study highlights the need for managers to invest in developing an organizational culture that supports both individual and organizational objectives. The conclusions align with Braicu C., Rogozeanu C.L. (2024, p. 25-31), who emphasize the importance of feedback-driven culture and periodic evaluations for maximizing performance in service organizations.

- Theoretical Implications for Performance Management and Organizational Culture

This study aims to provide a deeper understanding of the complex relationship between performance management and organizational culture, demonstrating their reciprocal influences in service organizations.

Findings from other studies support Hofstede's (2001, p. 110-113) theories on the impact of organizational culture on employee performance. Dimensions such as collectivism and power distance directly influence the effectiveness of performance management.

Practical Recommendations for Service Sector Managers:

- Developing an Employee-Centered Organizational Culture: Managers should encourage an open culture that supports collaboration and innovation. Armstrong (2017, p. 142) highlights that employees who feel valued and supported are more motivated to achieve superior performance.

- Integrating Performance Management Systems with Organizational Culture: Aligning performance evaluation strategies with organizational values is essential. Kaplan & Norton (2004, p. 160-162) recommend using performance indicators that reflect not only financial goals but also employee satisfaction and development.

- Investing in Training and Professional Development: Organizations investing in continuous employee development achieve better performance and higher retention rates.

Possible Study Limitations and Directions for Future Research. While the study offers valuable insights into the relationship between performance management and organizational culture, several limitations should be considered:

1. Limited Sample Size: The study focuses on a relatively small number of organizations, which may limit the generalizability of the results. Future research should include larger, more diverse samples (Saunders et al., 2019, p. 280-282).

2. Predominant Use of Quantitative Methods: While quantitative analysis provides a clear view of variable relationships, a deeper understanding would require more qualitative methods, such as detailed interviews or participant observation (Creswell, 2014, p. 112-114).

3. Socioeconomic Context Impact: The results may be influenced by the national context of the analyzed organizations. Future studies should explore whether the findings apply to other countries or sectors to understand specific cultural influences.

5. Conclusions

This study aims to investigate the reciprocal influences between performance management and organizational culture in service organizations. The analysis and interpretation of future collected data will determine whether:

➤ Organizational culture significantly influences employee performance, especially in organizations emphasizing collaboration, innovation, and individual recognition. Hofstede (2001, p. 120-122) suggests cultural dimensions like collectivism and openness to innovation contribute to superior employee performance.

➤ Performance management aligned with organizational culture improves employee satisfaction and commitment, leading to better retention and productivity.

➤ Organizations investing in continuous employee development positively impact overall performance, highlighting professional development as a catalyst for employee satisfaction and organizational growth.

➤ Promoting a culture of innovation and collaboration shows that a culture fostering teamwork and creativity enhances performance and adaptability to market changes.

According to Armstrong (2017, p. 165), prior research has focused more on industrial sectors, making this study a necessary contribution to the service sector. Additionally, this study complements findings by Kaplan & Norton (2004, p. 170-172), which indicate that aligning performance management strategies with organizational values not only improves performance but also strengthens organizational culture.

Future Research Directions:

➤ Expanding the study to include organizations from various industries and countries.

➤ Using a mixed-methods approach to gain deeper insights into the complex relationships between culture and performance.

➤ Investigating the influence of other variables, such as leadership style or digitalization, on the culture-performance relationship.

The research will contribute to the existing knowledge of the relationship between performance management and organizational culture, particularly in the context of Romanian service organizations, offering both confirmation of existing theories and new perspectives on how these variables interact, thereby making a significant contribution to the field.

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Technology Business Perspectives on Quantum Communication – A Survey-Based Study

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Abstract

The aim of this survey-based study is to provide insights into the current awareness perception and expectations that businesses representatives see in the emerging field of quantum communication technology. Quantum communication is revolutionizing the way we perceive data security, transmission and networking. In a close future we expect to use communication systems that are more secure, efficient, and potentially transformative for various industries.

The study focuses on how businesses are preparing for the potential commercial applications of quantum communication, the challenges they might face in integrating this technology, and their expectations for its impact on specific sectors.

A further development of the study on larger population and diverse regions would provide relevant information for policy makers in shaping policies and funding strategies to promote the growth of quantum communication.

Key words: technological capabilities, private investment, governmental investment, defense, scalability

J.E.L. classification: L63, L86, O31, O33

1. Introduction

Quantum communication is an emerging field that leverages quantum mechanics to revolutionize secure data exchange by introducing new paradigms for secure information exchange, through the incorporation of quantum mechanics principles like entanglement and superposition. Quantum communication is emerging as a transformative technology with the potential to revolutionize secure data transmission, cryptographic protocols, and network infrastructure. Unlike classical communication systems, quantum communication leverages principles such as quantum entanglement and superposition enable ultra-secure communication channels resistant to eavesdropping. With advancements in quantum key distribution (QKD) and satellite-based quantum networks, governments, research institutions, and technology firms are investing heavily in the development and commercialization of quantum communication technologies.

Despite the rapid scientific progress in quantum communication, its adoption and commercialization remain in early stages, influenced by technological, economic, and regulatory factors. Businesses operating in the technology sector must navigate the uncertainties associated with quantum readiness, infrastructure costs, and the potential disruption of classical encryption systems.

Understanding the perspectives of industry stakeholders, ranging from startups and telecommunications firms to cybersecurity enterprises, is crucial for assessing the commercial viability and strategic positioning of quantum communication technologies.

This paper presents a survey results supporting awareness and perception of respondents on quantum related businesses, as well as the anticipation of further technological developments from the perspective of business opportunities. By gathering insights from industry professionals and

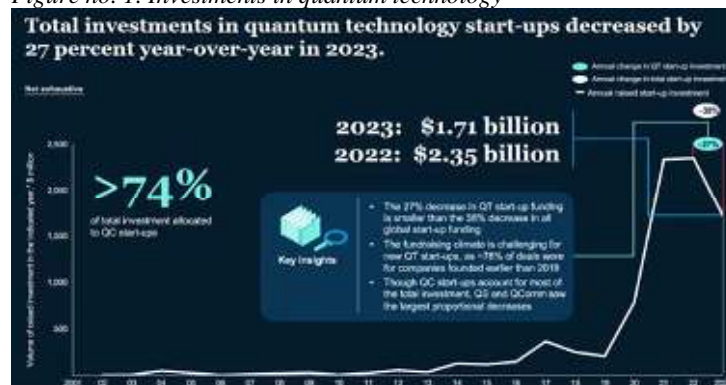
researchers, we assess the key drivers, barriers, and expected market trajectories. The findings aim to contribute to a deeper understanding of how businesses perceive the opportunities and challenges of quantum communication.

2. Literature review

A structured literature review on quantum communication's fundamental principles and industry, highlighting the transformative effect of the advancement of technology in communication, was made by Aware and Pande (2023). Seskir and Aydinoglu (2021) have analyzed over 49,000 articles on quantum technologies, clustering them into quantum communication, computation, and physical systems. Relevant published research provides an extensive account of quantum communication theory, emphasizing modern approaches and covering classical communication, entanglement, and private communication (Khatri & Wilde, 2020). Chen (2021) described the progress in quantum communication and computing, focusing on applications like teleportation, cryptography, and quantum networks while Gisin and Thew, (2010) explore the transformative impact of quantum communication technologies on society and the economy.

According to Gisin and Thew (2010) "first applications have already found their way into niche markets, and university labs are working on futuristic quantum networks", paving the way to effective applications ranging from secure cryptographic systems to quantum networks. Efforts to build quantum communication networks are emerging worldwide, including satellite-based systems and local area networks, aiming to achieve global-scale quantum-secured communication (Xu, 2014). To support the growing field, there is a need to educate future quantum engineers and researchers to overcome the gap between theoretical understanding and real-world applications (Razavi, 2018). Investment in quantum technologies is consistent, of approx. 42 billion USD from public funding. Although private and corporate funding for start-ups slowed from prior years, specialists foreseen a 2035 market size of 11-15 billion USD for quantum communication (McKinsey & Company, 2024). In Figure no. 1 is represented the total investments in quantum technology from 2002 to the most recent available data in 2023.

Figure no. 1. Investments in quantum technology



The investment decrease represented in the above figure can be explained by the challenges like scalability, integration with classical systems, and cost reduction that quantum communication faces (Diamanti, 2021). The rapid advancement of the quantum technologies ecosystem made imperative the assessment of the maturity of these technologies and their imminent acceleration towards commercial viability (Purohit, 2024).

3. Research methodology

The methodology used for this study is based on a survey aimed to gather insights from business representatives about their awareness, perception, and expectations of quantum communication technology. The survey aims to understand a wide range of perspectives on how organizations view

the technology's potential impact on strategy and innovation. The study is targeting professionals from diverse industry sectors and organizational roles and the focus is on businesses' preparedness, perceived benefits, and challenges related to quantum communication.

Regarding the structure, the survey is divided into four main sections with a total of 10 questions. The number of questions was minimized in order. The survey starts with demographic questions (3 questions). Such section has the aim to collect background information about respondents, including industry sector, organization size, and role. The next section of the survey is related to awareness on quantum communication, having the aim to gauge respondents' familiarity with quantum communication and their sources of information: *From 1 to 10, how familiar are you with quantum communication technology?* and *What sources of information have contributed to your awareness?*

The next section is inquiring the perception of the respondents in order to understand how respondents view the significance and applications of quantum communication in their industry. *How significant do you think quantum communication will be for your industry?* (1-10 scale); *What specific applications do you foresee for your industry?* *What benefits do you expect quantum communication to bring?*

The last section of the survey has the aim to assess expectations and challenges of related businesses and explores which sectors might benefit first from quantum communication, as well as identified barriers.

The survey consists in multiple-choice questions and Likert scale ratings (e.g., familiarity and significance ratings) and open-ended questions to collect free-text responses to capture detailed insights on applications and benefits. Multiple-selection questions were also included, for identifying barriers and sectors expected to benefit first.

The survey has been shared with local business representatives in Constanta region, Romania, between start of September to end of November 2024. Participants to the survey came from startups, SMEs, large enterprises, and universities. The dataset included representatives from organizations of all sizes in retail, commerce, education, telecommunications, defense, research, logistics and information technology, ensuring diverse perspectives.

4. Findings

We observed a diverse range of roles across various sectors, with a significant concentration in defense, national security and cybersecurity. Many responses indicated a direct involvement in defense and national security. Cybersecurity is another prominent field with strong emphasis on digital security, possibly in response to the growing need for security in digital infrastructures. Valid replies were also received from organizations involved in technology-driven sectors like cloud computing, but a significant number of responses were submitted by respondents in academic and training roles.

Respondents' awareness of quantum communication (*question 5*) is shaped primarily by three key sources: academic research, industry conferences, and media, with training programs also playing a notable role. The most frequently cited source being academic research, this implies that quantum communication is still a highly specialized and research-driven field and universities, research institutions, and scientific publications are key drivers of knowledge dissemination in this area.

Analysis of responses to *"From 1 to 10, how familiar are you with quantum communication technology? Where 1=I have never heard of it ...10 = Expert"* indicate a moderate to low level of familiarity with quantum communication technology, with ratings between 3 and 5. This suggests that while respondents have some awareness, they do not consider themselves experts, and their understanding remains limited or introductory. Many replies received from the respondents were of 1 meaning a lack of knowledge on what quantum communication technology is. These results are commented below, in the section Limitation of research.

The responses collected to the question *"What specific applications of quantum communication do you foresee for your industry?"* highlight security, efficiency, and technological advancement as key drivers of quantum communication adoption. Responses such as High Secure VPN applications, Quantum Key Distribution (QKD), and securing 5G communications, suggest that industries are prioritizing data protection and resilience against cyber threats. The emphasis on critical

infrastructure protection signals that sectors like finance, energy, and telecommunications anticipate quantum communication as a strategic necessity for safeguarding essential services. The mention of autonomous ships requiring continuous data exchange and X-band satellite communication improvements suggests that quantum communication could enhance logistics, defense, and aerospace by enabling secure, high-speed data transfer. Furthermore, the reference to fast and secure satellite media storage and streaming indicates that industries handling large-scale data, such as media, surveillance, and geospatial intelligence, expect quantum communication to drive efficiency and reliability in data-heavy workflows. Finally, the response about a platform for AI model training and deployment using quantum computing points to the potential for synergies between quantum communication and AI, particularly in cloud computing, research, and high-performance computing applications. From a policy perspective, these responses indicate the need for new regulatory frameworks and investments to support quantum-secure infrastructure. The mention of cybersecurity in student data management highlights concerns about data privacy and compliance, which could lead to new standards for educational institutions and public services. Securing 5G communications and critical infrastructure means that policymakers may need to mandate quantum-safe encryption and ensure that telecommunications and essential services adopt quantum-resistant protocols. As industries explore autonomous systems and AI integration, regulatory bodies may also need to address ethical and security concerns in this regard.

Replies collected to the question *"What benefits do you expect quantum communication to bring to your sector?"* vary from *"security increased"*, *"better education"*, *"faster data analysis and less packet intrusions"*, *"Secure communication between ships and authorities, new skills for students, secure data transmission, which can significantly improve the security of communications (...) as well as promoting research in these highly relevant fields"*, to *"revolutionize cybersecurity by ensuring secure data transmission"*, *"revolutionize areas like distributed computing, cloud computing, and high-performance computing"* or *"more reliability and efficacy"*. Such replies highlight a strong expectation that quantum communication will enhance security, efficiency, and innovation across various sectors. The emphasis on secure data transmission aligns with growing concerns about cyber threats, while the mention of faster data analysis and reduced packet intrusions suggests potential cost savings and operational improvements, making quantum communication attractive for sectors that rely on real-time decision-making (e.g., logistics, finance, and healthcare). Furthermore, the reference to reliability and efficacy indicate that businesses anticipate fewer disruptions and better performance in critical communication networks. From a policy perspective, the responses indicate that quantum communication is seen as a strategic technology for national security, education, and digital infrastructure. The emphasis on secure communication between ships and authorities underscores its potential role in maritime security and law enforcement, which could drive new regulatory frameworks. The expectation that quantum communication will promote research and education suggests a need for public investment in workforce development to ensure that industries and governments have the necessary skills to adopt these technologies. Policymakers may need to address issues related to data sovereignty, cross-border regulations, and infrastructure investments and governments may push for quantum-safe encryption standards, requiring businesses to adapt to new compliance measures.

Analysis of the responses to *"Which sector do you believe will be the first to benefit from quantum communication?"* indicate a strong consensus that security-driven sectors will be the earliest adopters of quantum communication. The most frequently mentioned sectors were defense and national security, cybersecurity and telecommunications with additional mentions of cloud computing, financial services and data centers.

The replies collected to the last question *"What do you perceive as the main barriers to adopting quantum communication?"* highlight several barriers to adopting quantum communication, with a clear focus on infrastructure, costs, and workforce issues. Prevalence of *"high costs"* appear in almost every response and is related to financial constraints which are a major concern across responders that hold various roles in the organization. The high initial investment needed for quantum communication infrastructure, research, and development could deter many organizations from adopting this technology and cost-effective solutions, funding, or financial models (such as public-private partnerships) might be necessary to overcome this barrier. Many responses also cite *"lack of infrastructure"* as a key barrier which relates to lack of physical specialized infrastructure (e.g.,

quantum communication networks) and indicate that quantum communication is not yet widely accessible and requires substantial investment in new technology, networks, and facilities. Organizations might face challenges in scaling up quantum communication systems without substantial upgrades to their existing infrastructure. The *"lack of skilled workforce"* is also frequently mentioned, especially in technical and academic roles, in line with a clear gap in the availability of skilled professionals who can design, implement, and maintain quantum communication systems. This result suggests a need for education, training, and talent development in quantum technologies to support future adoption. Organizational inertia can be another significant challenge in adopting disruptive technologies. Companies might need to focus on changing management strategies, leadership buy-in, and educating stakeholders to overcome this barrier. With quantum communication still being an emerging field, the uncertainty regarding its financial benefits (e.g., whether it can provide a competitive advantage or cost savings) could hinder adoption. *"Interoperability with existing systems"* is noted as a barrier by some respondents, particularly in executive and academic roles. Overall, the responses highlight significant barriers to adopting quantum communication, particularly related to costs, infrastructure, and workforce issues. Future businesses related to quantum communication technologies must focus on overcoming these barriers through education, strategic investments, and clear communication of the long-term value of quantum communication.

5. Limitation of research

The survey highlights a significant gap in awareness about quantum communication. While 43 replies were received in total, the sample size was reduced by 77% due to a high non-completion rate. Only 10 responses were considered valid as they provided insights from individuals aware of quantum communication concept while the rest of 33 respondents have replied with "1" at the question *"From 1 to 10, how familiar are you with quantum communication technology?"*, where 1 indicated the total lack of knowledge on quantum communication and therefore they ended survey completion.

Such results highlights a significant lack of awareness about quantum communication within the target population of businesses representatives and employees in Constanta county, Romania, for the 2024 period. The majority's unfamiliarity with quantum communication suggests that local businesses and industries may not yet recognize its potential economic implications. This could signal a need for increased education, outreach, and investment in awareness campaigns to bridge the knowledge gap. A small sample size can't capture the full range of the national industry perspectives, leading to potential bias, therefore the study needs to expand the target group with respondents outside Constanta County.

6. Conclusions

The survey-based study on business perspectives in quantum communication aimed to gather and analyse responses from local industry leaders, researchers, and technology companies to understand their perspectives on the current state of quantum communication related businesses. The aim of the survey was to envision the readiness of industries to adopt quantum communication technology. The small number of respondents familiar with the concept of quantum communication may indicate that such concept is still in its infancy in terms of adoption and understanding. Expanding participation will enhance the survey's impact and reliability, making it more useful for guiding strategic decisions in quantum communication adoption. Policymakers and industry leaders must account for this knowledge gap when planning strategies for quantum technology integration. Related to the structure of the respondents, the consistent representation from the Education sector indicates a growing academic focus on quantum communication, which is crucial for research and workforce development, while the inclusion of telecommunications, defense research, and IT reflects the sectors where quantum communication has practical and strategic significance. Results of the survey indicate several challenges in quantum communication related business like the technical, regulatory, and financial barriers to the widespread adoption, beside issues with scalability, reliability, and the need for specialized hardware.

However, the literature review indicates a potential market for quantum communication solutions. Future business opportunities arise from quantum communication, including partnerships, product development, and consulting services, encouraged by the governmental and private investments in research and commercialization. Quantum communication services have the potential to improve sectors like finance, healthcare, telecommunications, defense, transport and supply chain, suggesting the possibility of disruptive innovations or market shifts.

Businesses see quantum communication as a way to enhance security and efficiency, while policymakers must prepare for regulatory challenges, workforce development, and infrastructure investments to maximize its benefits. They anticipate enhanced security, efficiency, and new technological capabilities, while policymakers should focus on regulatory adaptation, investment in quantum infrastructure, and workforce development to maximize the benefits of quantum communication.

We consider the survey provided primary insights into industry perspectives, and represents a starting point for extensive research helping researchers and policymakers understand the current landscape and readiness for quantum communication. The expansion of the responders' target group could bring valuable input to guide businesses, researchers, and governments in addressing challenges and prioritizing resources for quantum communication development.

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Cognitive Systems in Branding: Linking Neuromarketing, Emotions, and Subliminal Persuasion to Customer Choices through the IMPACT Method

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Abstract

This paper explores the cognitive processes underlying branding and consumer behavior, emphasizing Kahneman's System 1 and System 2 framework and its extensions. Key theories, including Zhao's three-system model and Rottenstreich et al.'s focus on memory-based versus stimulus-based choices, highlight how emotional and intuitive (System 1) and rational (System 2) processes influence customer decisions and purchases. Neuromarketing strategies leverage emotions, subliminal cues, and persuasion to create intuitive brand associations, while rational deliberation reinforces logical justifications for consumer choices. Insights from dynamic dual-process models and regret theory further illuminate how urgency, emotions, and decision context shape behavior. By integrating feeling and thinking in branding strategies, this study bridges the gap between emotional engagement and rational decision-making, offering actionable frameworks for neurobranding, mainly through the IMPACT method, developed by the author – built with the aim of fostering customer loyalty and purchase decisions.

Key words: neuromarketing, branding, emotions, persuasion, subliminal
J.E.L. classification: D83, D87, D90, M30, M31, M39

1. Introduction

Neurobranding is a multidisciplinary approach that combines knowledge from marketing, psychology, and neuroscience. It focuses on how the brain creates brand attachments by interpreting memories, emotions, and subconscious clues. This interdisciplinary approach integrates psychology, neuroscience, and marketing to decode the unconscious processes driving brand loyalty, preference formation, and decision-making.

Brands constantly use a mix of emotional appeals and logical arguments to try to change consumer behavior. However, little is known about how the two cognitive systems—System 1, which controls emotional and intuitive decisions, and System 2, which handles logical thought—interact in the branding context. Initial brand perceptions are frequently dominated by emotional and intuitive processes, whereas complex purchase decisions and long-term loyalty are influenced by deliberative reasoning. Furthermore, there are ethical questions regarding transparency and consumer autonomy raised by the use of sensory triggers and subliminal persuasion. Recognizing how companies can integrate affective and cognitive systems and engage the five senses holistically, this article describes a method that the author created while developing their activity as a branding strategist. With an emphasis on incorporating emotional triggers to elicit particular actions, the approach makes use of the interaction between Kahneman's System 1 and System 2 of thinking, applied throughout the customer journey.

Since emotional appeals not only grab attention but also have a deeper impact on consumer behavior than purely rational ones, they are crucial to contemporary branding. Studies highlight their significance by demonstrating that emotional reactions to commercials are a better indicator of their efficacy than content-driven considerations.

Branding experts can use the method described in this paper to map cognitive processes to the awareness, consideration, purchase, post-purchase, and advocacy phases of the customer journey in an organized manner (Lemon and Verhoef, 2016). In order to improve customer engagement and foster enduring brand loyalty, it provides practical advice on how to incorporate emotional triggers and strike a balance between intuitive and logical appeals. This approach bridges the gap between cognitive science and practical branding strategies by fusing theoretical concepts with real-world applications, making it a crucial tool for marketers.

The IMPACT Method is a core component of the NeuroMap Branding System, a larger framework developed by the author. The NeuroMap Branding System gives branding experts structured tools, flexible strategies, and useful techniques for achieving successful positioning and differentiation for their clients. The IMPACT Method creates a dual-layered neurobranding strategy by addressing both System 1 and System 2 thinking, guaranteeing that consumers' emotional tendencies are backed by logical trust in the brand.

2. Theoretical background

From Decartes' mind-body dualism in the 17th century to Posner and Synder's formal representation of the (first) dual process model of the mind in 1975, philosophers, psychologists, and scientists have long distinguished between intuitive and conscious thinking. However, the distinction between automatic and deliberate thought processes did not gain widespread recognition until Daniel Kahneman used the terms System 1 and System 2 in his 2011 best-selling book "Thinking Fast and Slow" (Stanovich and West, 2000; O'Brien, 2012). He emphasizes essential elements of human perception and experience processing. According to Kahneman's approach, the mind functions as two separate systems:

- 1) System 1 - the brain's quick, instinctive, and intuitive method. The natural mental processes that we are born with, such as the ability to perceive our surroundings, identify items, focus our attention, prevent losses, and be afraid of spiders, are all included in System 1 activity. Long-term practice makes other mental processes quick and automatic (Walsh, 2014).
- 2) System 2 - the slower, analytical mode of the mind, where reason dominates. System 2 activity is typically triggered when we do an action that is not instinctive and necessitates a conscious mental effort.

The following puzzle is frequently used as an example to illustrate the two systems: *the total cost of a bat and ball is \$1.10. The bat is one dollar more expensive than the ball. How much does each cost?* When presented with this puzzle, most people guess 10 cents right away. However, the right response is 5 cents, which most individuals can figure out after giving the question more thought. This has long been cited as the ideal illustration of how our thought processes are governed by two different brain processes: quick and intuitive and slow and analytical.

The theory's goal was to offer a useful parallel that may direct our comprehension of how our minds process information, and it succeeds admirably in doing so. Using a System 1 and 2 lens to analyze behaviors has been very helpful in expanding our knowledge of human behavior and decision-making as well as in determining how we can affect or direct actions in various directions.

Zhao (2021) brings into focus a three-system theory, based on the fact that information from the outside world simultaneously enters your conscious and unconscious levels of processing when you are in a state of focus. Here is where System 3 enters the picture: external stimuli are filtered through System 3, which then forwards conscious information to System 2 and unconscious information to System 1.

This is comparable to a closed loop in which System 1's unconscious information is converted into System 2's conscious information via System 3 and System 2, and System 2's conscious knowledge can be converted back into System 1 via System 3.

Rottenstreich, Sood, and Brenner's work highlights the tension between emotionally charged (System 1) and deliberative (System 2) processes. For example:

- Emotionally rich choices (System 1): stimulus-based branding strategies create immediate allure.
- Rationally attractive options (System 2): memory-based choices rely on long-term consumer evaluations, such as selecting a brand known for reliability and cost-effectiveness.

Table no. 1 Short comparison between the most relevant cognitive processing models that represent the foundation of the IMPACT Method

Model	Core idea	Relevance to branding	Key differentiator	Brand application
Daniel Kahneman's Dual-system model	Kahneman's foundational framework distinguishes fast, intuitive, emotional System 1 from slow, deliberate, rational System 2 thinking.	His work underpins the broader field of neuromarketing and branding strategies, showing that most consumer decisions are driven by System 1, with System 2 providing rational justifications.	Kahneman's model focuses on the inherent biases and heuristics in each system without emphasizing habitual or repeated behavior explicitly (as Zhao does).	Focuses only on Systems 1 and 2.
Rottenstreich, Sood, and Brenner's Dual-system insights	emphasize how emotional (System 1) and rational (System 2) processing interact in decision-making, specifically contrasting memory-based choices (System 1 dominant) and stimulus-based choices (System 2 dominant).	Their work highlights the context-dependent dominance of Systems 1 or 2 in branding, stressing that emotional and logical branding strategies should align with whether decisions are habitual, memory-based, or stimulus-driven.	They argue for a dynamic interplay between Systems 1 and 2. Their model stays within dual-system framework but emphasizes memory vs. Stimulus choices.	Discusses dynamic dominance of Systems 1 and 2 based on choice type. <ul style="list-style-type: none"> • Memory-based choices: Relate to deep-seated emotional associations. • Stimulus-based choices: require immediate evaluation, such as choosing a product from a new brand based on available information or appeal.
Zhao's Three-system cognitive processing model	Extends Kahneman's two-system model by introducing a third system—habitual processing. This system operates below System 1 and governs automatic behaviors formed through repeated actions.	Habitual processing explains long-term brand loyalty and repetitive purchases, emphasizing the importance of consistent branding to establish consumer habits.	Places significant weight on habitual behaviors as an autonomous cognitive layer, rather than framing it as a byproduct of System 1.	Highlights long-term brand loyalty through habits.

Source: developed by the author based on literature review

Based on these, while implementing strategies as a branding strategist, the author considered that Zhao's third system could be integrated into Rottenstreich et al.'s work to explain the continuum of consumer decisions—from habitual (automatic) to stimulus-driven (rational). From this point of view, a working flow has been developed in order to create branding strategies aimed to:

- Trigger System 1 for initial emotional appeal.
- Strengthen System 2's logical validation to build trust.
- Reinforce habitual engagement through consistent exposure and brand reliability (Zhao).

Together, these perspectives enrich the understanding of how consumers navigate decisions in branding contexts, offering nuanced applications for both theoretical research and practical marketing strategies.

3. Research methodology

By incorporating current cognitive theories and useful insights from the author's professional experience, the methodology of this paper aims to create and define a conceptual framework for NEURObranding creation. Insights from professional practice and scholarly literature are combined in the author's theoretical and experiential approach. In order to develop a conceptual framework specific to NEURObrand creation, the paper incorporates knowledge from existing cognitive models (such as System 1 and System 2) and theories of multisensory branding. It focuses on determining how cognitive models align with practical strategies to influence customer choices.

A multidisciplinary viewpoint is presented by synthesizing pertinent works from marketing, neuroscience, psychology, and artificial intelligence. Scientific publications, books, and national and international databases covering both basic and recent research in neuromarketing, psychology, and consumer behavior are examples of sources. Since no primary data was gathered, the study's analysis is framed by secondary data and accepted theories. The research is grounded in practical application through the inclusion of case studies from the author's consulting practice, which complements the theoretical review.

4. Findings

With a focus on how the principles of cognitive processing apply to consumer behavior and brand engagement, one might take into account that branding often leverages System 1 thinking because consumer choices are frequently intuitive, driven by emotions, and made quickly without deep cognitive deliberation. Neurobranding taps into System 1 by utilizing emotional triggers, sensory experiences, and subconscious associations.

Brands use colors, imagery, and storytelling to evoke immediate feelings or memories that resonate with System 1, as emphasized in Table 2.

Table no. 2 How neurobranding taps into System 1

System 1 – Fast thinking Automatic, fast, and emotionally charged decision- making Most brand- related decisions occur here.	Emotional triggers	Sensory branding	Visuals (colors, logos), sounds (jingles), and smells (product scents) evoke emotions and create subconscious associations with a brand.	Strategies focus on creating an immediate emotional impact and bypassing extensive cognitive deliberation
		Emotional storytelling	Narratives that appeal to values, memories, or aspirations.	
		Brand personality	Infusing brands with human-like traits fosters emotional connections.	
	Subliminal messaging	Implicit branding	Embedding logos, symbols, or themes in ads to influence consumer perception without overt awareness.	
		Priming	Subconsciously associating positive traits with a brand to drive preferences	
	Memory-based branding	Associative memory	Building strong brand associations tied to emotions.	
		Repetition and familiarity	Requent exposure to brand elements (logos, slogans) ensures they are intuitively recognized and preferred, as familiarity breeds trust.	

Source: developed by the author based on literature review and practical experience

By creating stimuli that avoid critical analysis and elicit instantaneous reactions, neurobranding mainly depends on System 1. Building familiarity through verbal or visual repetition fosters trust, and techniques for gently introducing audiences to cues that influence perception may be used here. When it comes to influencing customers' decisions during their initial interactions with a brand, it is crucial to use imagery that supports their emotional goals (such as happiness or belonging) and to keep messaging brief to prevent overloading System 2.

By using messages that are consistent with a consumer's values or logical reasoning, neurobranding will therefore activate System 2 (e.g., emphasizing product quality, sustainability, or value-for-money). Given this, a brand strategist must maximize the aspects of a brand that consumers anticipate remembering it in the future. Considering these, it becomes important to have a notion of the features and advantages that are unrelated to what people are actually trying to accomplish by buying the brand.

Table no. 3 How neurobranding taps into System 2

<p>System 2 – Slow thinking</p> <p>Slow, deliberate, rational and analytical</p> <p>While less dominant, this system validates or justifies decisions.</p>	Informational branding	Feature and benefit highlighting	Detailed descriptions of product features and how they address consumer needs.	Strategies emphasize logical appeals, detailed information, and value propositions to satisfy conscious scrutiny
		Comparison marketing	Positioning products against competitors by emphasizing measurable advantages	
		Transparency	Highlighting ethical practices, sourcing, and certifications appeals to consumers concerned with sustainability and corporate responsibility.	
	Value proposition	Cost-effectiveness	Demonstrating monetary value, such as discounts, long-term savings, or superior quality-for-price comparisons.	
		Functional benefits	For example, promoting a hybrid car's fuel efficiency as a rational choice.	
	Decision support tools	Customer reviews and testimonials	Providing logical evidence through peer experiences.	
		Technical demos	Detailed demonstrations of product functionality, common in industries like technology or appliances.	

Source: developed by the author based on literature review and practical experience

In neurobranding, one should apply Kahneman's work highlights – the biases he identified as *availability heuristic*, *anchoring*, and *loss aversion* in order to influence consumer decisions.

As previously mentioned, Zhao introduces a third layer of habitual processing as an extension of System 1. In branding, this corresponds to loyalty-driven behavior where consumers repeatedly choose brands due to ingrained habits, not active decision-making.

Based on real-world experience, the author developed the IMPACT method and insights. After working directly with small and medium-sized business branding for years, there weren't trends, obstacles, opportunities and patterns that have been methodically examined and combined into workable plans.

Consisting of 6 steps, the IMPACT method is designed to guide brands through a structured process of building deep, emotional connections with their audience – while grabbing attention and achieving differentiation based on authenticity.

Table no. 4. The IMPACT Method, developed as a framework with specific instruments used for encompassing the neurobranding process

	Step	Phases	Output:
I	Identify core emotional drivers and neurological insights for competitive positioning	1) Consumer analysis/Audience research – through surveys, interviews, social listening, sentiment analysis tools, A/B testing, psychographic profiling, behavioral tracking, archetypes, generational insights and emotional	A foundational understanding of emotional drivers, providing direction for the brand's identity and purpose that are appealing for emotional personas that guide all brand decisions

	Step	Phases	Output:
		triggers, consumption habits and other preferences analysis 2) Use of Psychological Models and define emotional triggers 3) Brand archetype alignment for emotional and psychological positioning	(ensuring the brand resonates with their emotional needs, fears, values, aspirations and motivations)
M	Mapping the emotional journey	1) Identifying the key emotional states based on awareness level when interacting with the brand 2) Developing an Emotional Blueprint that outlines emotional highs and lows across customer experience 3) Storytelling integration for increased engagement and guidance for transformation	A comprehensive emotional map of the customer journey that ensures every interaction strengthens the emotional connection to the brand.
P	Personalization in terms of sensory design and brand experience	1) Sensory elements alignment: colours, fonts, sounds, textures, shapes, shadows, spaces – all aligned with the brand's emotional tone. 2) Brand rituals: routines, events, actions and reactions associated with the brand 3) Refining through further research and A/B testing 4) Create a brand community where consumers can connect with the brand and each other. 5) Celebrate – customers, their journey and their loyalty 6) Monitor – emotional connection, experiences and feedback to identify opportunities for deeper engagement.	A multi-sensory brand experience enhanced by emotional connection that reinforces the brand's emotional identity and fosters a sense of community around shared values
A	Aligning and refining messages with persuasive, neuro-emotional copywriting	1) Persuasion techniques and curiosity-driven hooks 2) Messaged addressed to System 1 Thinking 3) Personalized and tailored messages for different emotional personas, addressing each segment's unique needs and values (Bayle-Tourtoulou et al, 2013) 4) Pulse testing for targeted, impactful copy that resonates emotionally and drives action	Deeply persuasive messages that leverage psychology and emotional triggers in order to generate action through compelling, emotionally resonant messaging that aligns with the brand's emotional and neurological insights.
C	Cultivate connection and trust through ethical principles	1) Brand manifesto crafted so that it fosters a sense of shared commitment with customers 2) Initiatives that align with the audience's values 3) Customer stories illustrating the brand's impact 4) Fostering a sense of belonging 5) Ethical review panel messaging – regularly updating and exposing the strategies and messages that align with the brand's ethical standards	An ethically grounded brand that creates meaningful connections with its audience.
T	Transform feedback and insights into ongoing innovation	1) Gather feedback 2) Real-time pulse checks	Continuously refine and adapt the brand based on consumer insights and

Step	Phases	Output:
	3) Analyze emotional data and/or patterns. Iterative documentation 4) Adapt based on insights 5) Track market trends 6) Review emotional profiles/journey maps every 6 to 9 months 7) Retrospective analysis. Adjustment	ensure it remains relevant and emotionally resonant by evolving based on new trends, and customer and market insights.

Source: developed by the author based on practical experience

By addressing both systems, the IMPACT Method creates a dual-layered neurobranding approach, ensuring that consumers' emotional inclinations are supported by rational confidence in the brand.

System 1 is automatic, emotional, and subconscious. Neurobranding techniques under the IMPACT Method align closely with System 1 by focusing on intuitive triggers that shape immediate perceptions and emotional bonds:

- instruments like colors, shapes, and sounds stimulate System 1 by triggering emotions and associations;
- storytelling components are crafted to engage System 1 through empathy and relatability, creating quick connections without requiring much cognitive effort.

These are intended to elicit strong feelings and connections with the brand, to foster loyalty and a sense of belonging. Thus, IMPACT method assists marketing strategists in developing unique, emotionally engaging brands that stand out in crowded markets and have a profound impact on consumers by coordinating branding initiatives with System 1.

System 2 validates and justifies the initial impressions formed by System 1. It processes more detailed information and logical arguments. The IMPACT Method incorporates this through tools and instruments that add credibility and clarity.

- data-driven claims or features are used to provide rational backing (that are supported logically by quantifiable attributes and advantages, like performance metrics or product certifications) to the emotions triggered by System 1;
- structured communication ensures System 2 isn't overwhelmed, supporting an analytical evaluation of the brand.

Additionally, the IMPACT method brings to attention the latent benefits and characteristics that go beyond the consumer's immediate objectives:

- 1) The emotional resonance (beyond utility) – the emphasis lies on creating copywriting messages and a brand manifesto that evoke emotions that are not directly tied to the products functionality – thus building a unique brand personality that is aligned with Aaker's (1997) dimensions of brand personality.
- 2) Social and cultural associations that usually contribute to social signaling through symbolism and affiliation – described by Solomon (2020) as a "psychological phenomenon where consumers use brands to project their identity"
- 3) Psychological comfort that relies on feelings of security and familiarity and tap on nostalgic connection and association with culture, tradition and childhood experiences – this also aligns with Kahneman's System 1, who mentions that "familiarity breeds trust and preference, often outside conscious awareness".
- 4) Unexpected value that generates brand loyalty – creating value that customers are not explicitly seeking (by generating emotional satisfaction through customer service or by building a sense of belonging, involvement and participation in greater causes). This element was also addressed by Plassmann et al (2012) when presenting their findings on emotional engagement as a key driver of loyalty.

By using these strategies, the IMPACT Method builds long-lasting credibility and trust, laying the groundwork for regular customer interaction. The author has effectively assisted clients throughout the United Kingdom in accomplishing the following goals by utilizing the IMPACT Method, which is a component of the NeuroMap Branding System:

- Brand differentiation - through a process of assisting companies in creating distinctive, emotionally appealing identities in order to differentiate themselves in crowded markets.
- Trustworthy connections – by establishing long-lasting bonds between companies and their clients by encouraging both emotional and intellectual assurance.
- Multisensory engagement – by creating/developing/using customized, multisensory experiences to encourage regular audience participation.
- Long-term impact: fostering long-lasting behavioral shifts and adding value for the audience and brand.

With its integration of flexible strategies, useful frameworks, and workable plans, the NeuroMap Branding System offers branding experts a full toolkit. The system aims to accomplish 1) brand positioning that works, 2) ethical strategies for differentiation - suited to particular markets and 3) alignment of reason and emotion using the IMPACT Method in order to create NEURObrands.

5. Conclusions

Brand positioning, differentiation, and enduring loyalty can all be greatly enhanced by incorporating dual-system theory and emotional triggers into the customer journey framework. In order to guarantee that branding strategies are absorbed on both the subconscious and conscious levels, this approach addresses both System 1 (intuitive, emotional thinking) and System 2 (rational, analytical thinking).

Using the IMPACT approach, the author helped clients throughout the UK to:

- create distinctive, emotionally compelling brands and differentiate themselves in crowded markets.
- create enduring, trustworthy connections with customers.
- promote consistent participation with tailored, multisensory experiences
- encourage long-term change and impact for the audience and the brand.

The main advantages of this approach include, but are not limited to:

1) Increased interaction with customers - brands can quickly grab consumers' attention by using emotional triggers like visuals, narrative, and sensory components to activate System 1. Deeper connections are cultivated through emotional engagement, which raises customer interest and involvement.

2) More effective brand positioning and differentiation - in competitive markets, differentiation is accomplished by satisfying both the rational and emotional needs of customers. While logical validation enhances credibility, emotional triggers help the brand connect with consumer values and become memorable.

3) Better decision-making – the IMPACT method streamlines the decision-making process for customers by using System 1 to influence preferences and System 2 to support selections. By smoothly navigating them through the customer journey, guaranteeing satisfaction, and lowering post-purchase regret, it lessens decision fatigue and increases customer loyalty.

4) Increased rates of conversion - by addressing both rational hesitations and emotional motivations, the interaction of System 1 and System 2 improves conversion rates. Transparent information reassures customers and lowers abandonment rates, while emotional triggers like urgency and exclusivity promote quick decisions.

5) A rise in client loyalty - engaging both cognitive systems after a purchase promotes enduring loyalty. System 1 is attracted to individualized and sympathetic communication, while System 2 is satisfied by useful post-purchase assistance. This dual emphasis strengthens brand loyalty and trust.

6) Encourages brand promotion - customers are more likely to become brand advocates when their emotional and practical needs are regularly satisfied. While logical incentives such as referral rewards encourage actionable recommendations, emotional triggers encourage pride in being associated with the brand.

7) Flexibility - many industries can benefit from the dual-system approach's adaptability. Any industry can use both logical and emotional appeals to target particular consumer behaviors, demographics, and values.

8) Impact on brand value (that can be measured) - both long-term brand equity and short-term performance metrics benefit from this strategy. Rational appeals improve customer trust and retention, increasing overall brand value, while emotional engagement produces a memorable and relatable identity.

Through the IMPACT method, the result of neurobranding process produces emotionally compelling experiences that have a profound impact on customers by comprehending cognitive functions including perception, attention, and decision-making.

Essential elements lie in identifying and emphasizing:

1) Emotional triggers – because emotions dominate people's purchase decisions, with reason frequently taking a backseat. In order to establish deep connections, neurobranding makes use of emotional connotations;

2) Subliminal messaging – because unconscious associations can be formed via subliminal cues, such as the use of delicate word choices in taglines or the incorporation of shapes and textures in designs;

3) Senses' engagement: brand memorability is increased by incorporating sensory cues that activate the brain's reward system.

4) Narrative and storytelling: according to neuroscience, stories stimulate several parts of the brain, including the empathy-related ones. Creating an engaging brand narrative "binds" customers to the brand on an emotional level.

The way that companies develop their strategies to appeal to quick, emotive, and intuitive thinking (System 1) while offering logical justification (System 2) to maintain and justify customer loyalty is where neurobranding and Kahneman's System 1 and System 2 connect.

Throughout the customer journey, incorporating dual-system theory with emotional triggers improves consumer engagement, fortifies brand differentiation, and fosters loyalty. Brands produce a thorough and significant customer experience by addressing System 1's intuitive procedures in addition to System 2's analytical validation.

This strategy works especially well for creating enduring emotional and intellectual ties with customers while giving brands a distinctive position in cutthroat marketplaces. Future studies should examine how this methodology can be applied to new platforms, like AI-powered personalization, which could increase its efficacy by adjusting both rational and emotional appeals to specific customers.

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The Impact of Physical Risks and Physical Activity Requirements on Employees' Health, Well-being, and Satisfaction

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Abstract

The physical and social work environment determines employees' health, well-being, and job satisfaction. The present study uses artificial neural network analysis to evaluate the impact of physical hazards and physical activity demands on these health-related outcomes. The results show that improving hazardous working conditions and reducing physical strain would significantly improve workers' health, well-being, and job satisfaction. The study highlights the importance of preventing physical workplace risks, such as noise exposure and harmful environmental factors, to achieve better employee outcomes. Overall, the research supports the premise that improving the physical work environment may lead to greater employee satisfaction and well-being—findings that have significant implications for organizational policies.

Key words: physical risks, physical activity requirements, employees' health, well-being, employees' satisfaction

J.E.L. classification: O15, O33

1. Introduction

In contemporary, fast-changing, diversified work environments, workers' health, well-being, and job satisfaction have become very important for both organizational effectiveness and personal fulfillment.

Research shows that many things in the workplace – physical hazards, demands of physical effort and quality of social relationships – affect employees' physical and mental health (OECD, 2013). For organizations aiming to enhance productivity and performance, understanding the complex relationships among these factors and their effects is essential (Bocean, 2011; Vărzaru & Vărzaru, 2015a, 2015b).

Physical risks in the workplace—those hazards that directly threaten employees' physical health—have evolved over the last few decades. Technological advances, along with shifts in regulations and job roles, have mitigated certain traditional risks while introducing new ones. Modern workplace risks may include exposure to hazardous substances, extreme temperatures, high noise levels, and social risks like bullying, harassment, and discrimination (OECD, 2014).

While specific physical risks can vary by industry, their impact on health and wellness is often considerable, especially when combined with high physical demands. Physical demands refer to tasks that require sustained physical effort, like prolonged standing, lifting heavy loads, or working in strenuous conditions. These demands are often unavoidable in specific industries, but when coupled with limited autonomy or low social support, they can lead to fatigue, injury, and decreased job satisfaction (OECD, 2016).

Given the complexity of these issues, this paper will evaluate the impact of physical risks and physical activity requirements on employees' health, well-being and satisfaction. By using existing literature and exploring the intersection of physical and social workplace environments, this study will provide an overall understanding of how these factors interact and the implications for organizational practices (Bocean, 2009). It will examine how physical risks and activity demands affect employee outcomes and how social support in the workplace can mitigate these effects. This research will contribute to the growing body of knowledge on workplace health and safety by highlighting the need to address both physical and social risks in modern work environments (Bocean, 2007; Sitnikov, C.C. and Bocean, C.G., 2010, 2013; Vărzaru and Vărzaru, 2013a, 2013b; Wright and Nishii, 2013; Vărzaru et al., 2013; Vărzaru and Vărzaru, 2016; Ganster and Rosen, 2013).

2. Theoretical background

One of the most significant aspects of a workplace that influences employees' health, well-being, and job satisfaction is the physical environment. The interaction with people who create a hostile atmosphere, along with the physical and social characteristics of the workplace, can substantially affect employee outcomes, irrespective of the hazardous nature of the work itself (OECD, 2013). These effects encompass physical risks and physical activity demands, critical challenges to employee health, well-being, and job satisfaction (Wilkinson., 2022).

Physical risks in the workplace refer to the extent to which job-related activities expose employees to conditions that may harm their physical health. Workers' perceptions of these risks are often shaped by their past experiences, as the impact of physical hazards can vary over time (Jermier et al., 1994; Wright & Nishii, 2013). Several common risk factors have been identified, particularly in manual labor environments. These hazards include exposure to extreme temperatures, high noise levels, harmful chemicals, infectious agents, workplace accidents, and even second-hand smoke (OECD, 2014; Bocean et al., 2021).

Both physical and social risks in the workplace affect not only employees' physical health but also their mental well-being, often creating a more challenging work environment. Research indicates that employees exposed to these risks are more likely to experience stress, anxiety, and burnout, reducing job satisfaction and overall job performance (LaMontagne et al., 2007; Bocean et al., 2023). Additionally, prolonged physical tasks without proper ergonomic support have been linked to musculoskeletal issues, increasing workers' health risks (Ganster & Rosen, 2013).

Workplace risks generally fall into two categories: objective hazards, which include tangible dangers like physical threats or exposure to toxic substances, and subjective risks, such as the psychological effects associated with bullying, discrimination, or harassment (Bhui et al., 2012). While a substantial body of research exists on the physical risks, less attention has been paid to the interactive effects of physical and social risks. Those exposed to both types of risks, for instance, are more liable to suffer from mental health problems such as anxiety and depression, which the individual and the organization have to bear huge costs (Galea et al. 2004).

Physical activity requirements at work refer to the extent to which employees are required to perform tasks that involve physical effort (Wilton, 2022). Examples include standing or walking for extended periods, working in tiring postures, or lifting and transporting heavy objects. Although these demands might not pose immediate health risks, they can harm employees' well-being in the medium and long term, particularly when combined with low decision-making autonomy and insufficient social support (OECD, 2016).

Studies on the impact of physical activity demand on employee health suggest that prolonged standing, repetitive motions, and heavy lifting can lead to chronic physical conditions, such as back pain, arthritis, and cardiovascular issues (Vischer, 2007). Moreover, excessive physical demands have been linked to employee exhaustion and dissatisfaction, particularly in occupations with low control over work schedules and a lack of appropriate rest periods (Bluyssen et al., 2011a).

Research also shows that psychosocial factors can exacerbate the impact of physical activity demands. Employees who experience high physical demands alongside job insecurity, poor social support, or bullying are more likely to report adverse health outcomes, including heightened levels of stress and reduced life satisfaction (Parkyn and Wall, 2020). This fact is especially problematic in industries where physical exertion is a core component of the job, such as construction,

manufacturing, and healthcare. These employees often face a higher risk of work-related injuries, which can further affect their mental and physical well-being.

3. Research methodology

This research investigates the impact of physical risks and physical activity demands on employee health, well-being, and job satisfaction through a multilayer perceptron (MLP) artificial neural network model, as other researchers (Nicolescu. and Vărzaru, 2020; Vărzaru, 2022a, 2022b, 2022c, 2022d; Rotea et al., 2023). The study utilized a quantitative approach, collecting data through a structured questionnaire designed to capture various physical risks and activity demands present in the workplace. The data collection process involved administering the questionnaire to a selected sample of employees across different industries, ensuring a diverse representation of work environments and job roles.

The input variables of the MLP model included a range of physical risk factors and activity demands associated with workplace conditions. The output variables include health, well-being, and employee satisfaction (Table no. 1).

Table no. 1 Selected variables

Input variables	Output variables
Working in dangerous conditions (RF11)	Feeling good about one's health (SF68)
Working in unhealthy conditions (RF12)	Protecting oneself and others from illness (SF69)
Exposure to the risk of serious injury or accidents (RF13)	Working in a safe environment (SF70)
Exposure to infectious materials or chemicals (RF14)	Feeling good overall (BA71)
Exposure to noise or vibrations (RF15)	Finding meaning and purpose in work (BA72)
Exposure to extreme temperatures (RF16)	Pride in one's work (BA73)
Exposure to second-hand tobacco smoke (RF17)	Personal satisfaction with work (SA74)
Performing heavy physical labor (CAF18)	Contentment with career progression (SA75)
Returning home exhausted from work (CAF19)	Feeling empowered to make important decisions (SA76)

Source: elaborated by the authors using data processed with SPSS v.27

The questionnaire, structured to measure these variables, was distributed to a sample of employees in sectors known for high levels of physical risk and physical demands, such as manufacturing, construction, and healthcare. Three hundred eighty-three respondents participated in the study, providing insights into their work environments and physical and psychological challenges. Respondents were asked to rate the extent to which they were exposed to each of these conditions using a Likert scale, ranging from 1 (never) to 5 (always). This approach allowed for quantifying physical risks and activity demands experienced by employees.

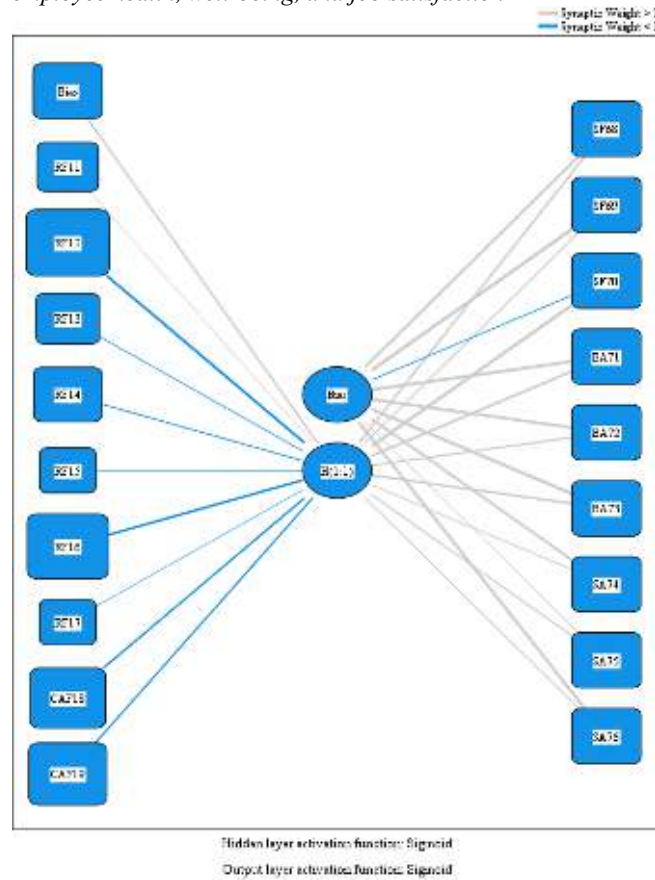
The collected data were analyzed using an MLP neural network model in SPSS version 27. The model examines the relationships between physical risks, activity demands (input variables), and employee health, well-being, and job satisfaction (output variables). The paper hypothesis is that Improving the physical working environment leads to better health outcomes, higher well-being, and enhanced job satisfaction. The MLP model was selected because it captures complex, non-linear relationships between variables. The model included a hidden layer representing employee well-being, hypothesized to mediate the relationship between the input variables and the outcomes of interest.

4. Findings

In order to evaluate the impact of physical risks and physical activity demands on employee health, well-being, and job satisfaction, we employed artificial neural network analysis. The multilayer perceptron (MLP) model includes an input layer with variables representing physical risks and physical activity demands (RF11-RF17, CAF18, CAF19) and an output layer with variables representing employee health, well-being, and satisfaction (SF68-SF70, BA71-BA73, SA74-SA76). Between these two layers, a hidden layer representing employee well-being (referred to as the "well-being" variable) influences health, well-being, and job satisfaction. The activation functions of both the hidden and output layers are sigmoid. Figure no. 1 illustrates the relationships established

between the model's layers.

Figure no. 1. The MLP model evaluating the impact of physical risks and physical activity demands on employee health, well-being, and job satisfaction



Source: elaborated by the authors using data processed with SPSS v.27

Table no. 2 presents the model parameters and the importance of the input variables in exerting their influence.

Table no. 2 MLP Model parameters for evaluating the impact of physical risks and physical activity demands on employee health, well-being, and satisfaction

Predictor		Predicted										Normalized Importance	
		Hidden Layer 1	Output Layer										
		H(1:1)	SF68	SF69	SF70	BA71	BA72	BA73	SA74	SA75	SA76		
Input Layer	(Bias)	0.737											
	RF11	-0.017										0.8%	
	RF12	-1.192										66.0%	
	RF13	-0.074										3.7%	
	RF14	-0.454										24.1%	
	RF15	-0.482										26.0%	
	RF16	-1.298										81.5%	
	RF17	-0.009										0.4%	
	CAF18	-1.555										100.0%	
	CAF19	-1.351										81.6%	
Hidden Layer 1	(Bias)		1.204	1.637	-0.174	1.509	1.201	1.406	1.227	0.355	1.184		
	H(1:1)		0.942	1.176	1.238	0.762	0.993	0.923	0.776	0.890	1.129		

Source: elaborated by the authors using data processed with SPSS v.27

The MLP model reveals that reducing physical risks, heavy working conditions, and exhaustion improves employees' health, well-being, and satisfaction. The analysis demonstrated that physical demands (performing heavy physical labor - CAF18, physical and mental exhaustion - CAF19, and exposure to extreme temperatures - RF16) significantly impacted health and well-being, with these variables showing high normalized importance. Other variables, such as exposure to accident risks (RF15) and unhealthy working conditions (RF14), significantly influenced the model's results.

These findings support the hypothesis that improving physical working conditions would improve health outcomes. Reducing exposure to risks such as noise, chemicals, or hazardous conditions and decreasing the demands for intense physical activity could enhance employees' well-being. Such measures could positively affect employee satisfaction, as the model's output variables show positive influences between well-being and satisfaction.

5. Conclusions

The results of this study highlight the significant influence that physical risks and physical activity demands have on employee health, well-being, and job satisfaction. By employing a multilayer perceptron (MLP) model, we demonstrated that reducing exposure to hazardous working conditions, physical labor intensity and exhaustion can substantially improve employee outcomes.

The analysis revealed that specific factors, such as exposure to accident risks, noise, vibrations, and unhealthy environments, have a profound negative impact on employee well-being and health. The high importance of these variables in the model underscores the need for targeted interventions in the workplace to mitigate their effects. Moreover, the findings validate the hypothesis that improving the physical working environment leads to better health outcomes, higher well-being, and enhanced job satisfaction. Reducing physical demands and minimizing exposure to hazardous conditions should be prioritized by organizations aiming to foster a healthier and more satisfied workforce.

The study also demonstrates the value of artificial neural networks in analyzing complex relationships between workplace factors and employee outcomes. The MLP model used in this research provided nuanced insights into how changes in physical risks and demands, directly and indirectly, affect employee well-being, offering a robust methodological approach for future research.

In conclusion, the implications of this research are clear: improving physical work conditions is beneficial for employee health and satisfaction and overall organizational performance. Policymakers and organizational leaders should focus on reducing physical risks and demands to enhance the well-being of their workforce, ultimately creating a more productive and positive work environment.

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Understanding Leadership Challenges in Rural Healthcare: A Bibliometric Approach

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Abstract

This study investigates the role of leadership in addressing workforce shortages and improving healthcare accessibility in rural areas through a bibliometric analysis. Utilizing data from Scopus and Web of Science, the study identifies critical themes, including leadership's impact on workforce retention, the integration of telemedicine, and the role of policy and academic-practice partnerships. Despite limited literature focused on rural settings, the analysis highlights leadership as a important factor in overcoming barriers such as geographic isolation, resource scarcity, and workforce attrition. This highlights the necessity for a approach that combines strategic leadership, technological advancements, and equitable policy-making to build resilient healthcare systems in underserved areas.

Key words: leadership, rural healthcare, policy implementation

J.E.L. classification: M12, I11, O15

1. Introduction

The growing shortage of health workforce in rural areas poses significant challenges for health systems around the world, especially in ensuring equitable access to quality healthcare services for disadvantaged populations. Rural healthcare facilities frequently face unique obstacles, including limited resources, lower rates of health workforce retention, and reduced accessibility to specialized care. These problems are compounded by an ageing population and rising demand for chronic care, which put additional pressure on already limited healthcare resources in rural areas. Leadership within health organizations plays a crucial role in addressing these challenges, but the specific approaches and strategies needed to manage and mitigate labor shortages in rural settings remain little explored.

In recent years, the need for effective leadership in rural healthcare has become increasingly evident. Leaders in these environments must address a complex interplay of factors from workforce development and resource allocation to implementing innovative solutions to improve healthcare delivery for rural populations. Although there is a growing body of literature on health workforce management, much of it is focused on urban or university-affiliated medical institutions, leaving a gap in understanding how leadership strategies can be adapted to rural settings.

With this paper we aim to provide a clearer understanding of how effective leadership can address structural and logistical challenges in rural healthcare, contributing to better retention, resource allocation, and accessibility for disadvantaged populations. By highlighting both potential strategies and limitations present in existing research, our study lays the groundwork for future research on sustainable, context-specific leadership approaches to improve healthcare delivery in rural areas.

2. Theoretical background

The issue of health labor shortages, especially in rural areas, has become a focal point in the health management literature, with significant implications for health policy, public health, and leadership studies. Our research shows that these deficits are not only due to demographic factors or

geographical isolation, but are also profoundly influenced by organizational and leadership practices, government policies, educational pathways, and economic considerations.

"The meaning of leadership is complex and includes many dimensions. For some people, leadership is a trait or skill, for others it is a skill or behavior, and for others it is a relationship or process. Leadership probably includes components of all these dimensions. Each dimension explains a facet of leadership (Northouse, 2011). Despite the huge differences between developing and developed countries, access is the major issue in rural health around the world. Even in countries where a large part of the population lives in rural areas, resources are concentrated in cities. All countries have difficulties in transportation and communication, and all face shortages of doctors and other health professionals in rural and remote areas (Strasser, 2003).

A major factor contributing to this deficit is the rural-urban disparity in educational and professional opportunities for health workers. A research by Humphreys and Wakerman in 2019 indicates that rural areas often lack access to comprehensive health education programs, which affects the flow of new health professionals. As a result, workforce retention strategies are a key objective of rural health leadership, highlighting the need for strong support systems, continuous training and improved working conditions.

The World Health Organization's Framework on Healthcare Accessibility highlights the importance of systemic changes that reduce barriers to care, advocating for policies that ensure the equitable distribution of healthcare resources (World Health Organization, 2016). Research on rural health systems highlights that improving access requires a varied approach, combining government policy, organizational support, and leadership that prioritizes health equity and addresses the unique barriers faced by rural populations.

Leadership in rural healthcare requires not only operational skills but also the ability to navigate and sustain the political landscape to secure the necessary resources and support. The researchers stressed the importance of aligning government policies and health organisations, noting that effective policy implementation can directly improve rural healthcare accessibility and workforce stability (Buchan et al., 2016).

Aspects such as distance, location, and even aesthetics of healthcare facilities can prove to be barriers to receiving healthcare in rural areas (Buzza et al., 2011).

3. Research methodology

The research methodology involved extracting data from the Scopus database using the keywords leadership, medical, labor force and rural, resulting in a total of 117 relevant articles. The extracted data were analyzed and processed using VOSviewer, which facilitated the visualization and identification of key themes and relationships in the literature.

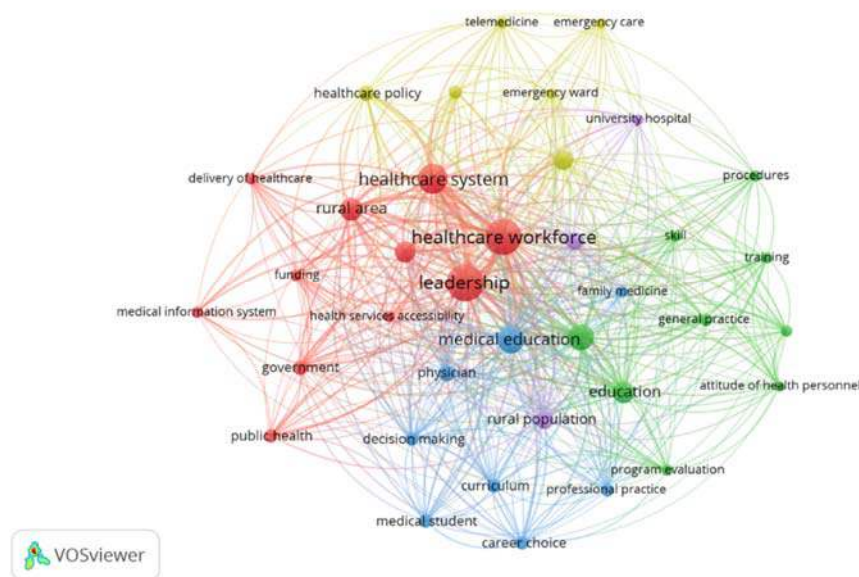
To complement the Scopus dataset, additional information was collected from grey literature sources, including Google Scholar, to broaden the scope of the analysis. World Health Organization reports were also consulted to provide additional information and context on the topic.

In addition to the bibliometric analysis conducted using Scopus, a complementary analysis was performed using data from Web of Science to explore leadership and workforce challenges in rural healthcare. This analysis included 137 articles published between 2010 and 2023, offering a broader understanding of thematic trends and gaps in the literature.

4. Findings

Analysis of data extracted from Scopus and processed through VOSviewer revealed five distinct clusters, each indicating critical dimensions of challenges and solutions associated with public health leadership, with a particular focus on rural areas. This grouping highlights both the specific needs and obstacles of this field, as well as potential avenues for intervention to improve access to health services.

Figure no. 1 The VOSviewer analysis of the Scopus dataset



Source: Authors' own based on literature review using VOSviewer

The VOSviewer analysis of the Scopus dataset seen in Figure 1 provides insights into the complex interaction of factors influencing leadership in rural health systems. The results reveal a multifaceted landscape where effective healthcare delivery in rural areas depends on a combination of accessible resources, skilled staff, supportive policies and innovative solutions to overcome geographical and infrastructure challenges. Leadership in this healthcare environment plays a key role in coordinating these elements to ensure that rural populations have equitable access to healthcare.

A repeating theme in the data is the critical role of systemic support for the health workforce. Ensuring that resources such as funding, health infrastructure, and government support are directed to rural areas is crucial for the sustainability of health services. Moreover, public health accessibility, workforce development, and healthcare management require strategic leadership to allocate resources effectively, especially in settings where the availability of healthcare personnel is often limited. Therefore, leadership is essential in supporting and implementing policies that prioritise access to rural healthcare.

Education and training are vital components in addressing the unique demands of rural healthcare, as building a competent and motivated workforce requires specialised programmes with a focus on rural health. Initiatives that promote positive attitudes towards work in rural areas, together with the continuous development of skills, are essential to overcome the challenges of the workforce in underserved regions.

Recent studies highlight that the incorporation of academic and structured training programmes into rural health systems significantly supports workforce development. For example, Calvin et al. (2023) demonstrated that process changes in rural practices could scale up rapidly and support academic appointments for doctors, increasing recruitment, retention and satisfaction.

Moreover, encouraging early exposure to rural healthcare during medical education is essential. Research shows that rural immersion programs tailored to the needs of the community are more effective than superficial exposure, as they instill a sense of connection with local populations and their health challenges (Ostini et al., 2023). However, the findings of You et al. (2021), suggests that students with higher academic performance are less likely to choose rural practice, highlighting the need for targeted strategies that align rural careers with professional aspirations.

The leadership of medical education institutions must prioritize training programs and pathways that address both technical skills and the unique requirements of rural practice. Such programs should aim to integrate service-oriented learning with academic and clinical excellence, ensuring that health professionals are well-prepared to meet the complex challenges of rural healthcare delivery.

Another aspect highlighted by our analysis is the importance of emergency services and primary health care, which are often limited or difficult to access in rural areas. Our findings indicate that healthcare delivery in these regions could be improved through innovative solutions such as telemedicine, which has the potential to bridge the gap created by geographical isolation. Telemedicine allows healthcare providers to expand essential services to rural populations by providing real-time medical consultations without the need for patients to travel long distances. Therefore, rural healthcare leadership must promote the uptake and integration of telemedicine solutions as part of a broader strategy to improve accessibility and ensure continuity of care.

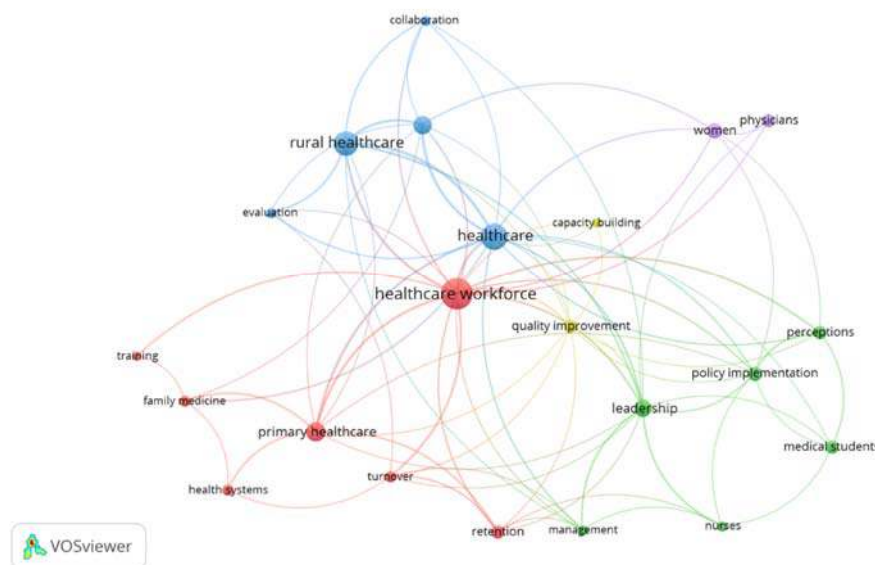
As noted by Woods et al. (2023), the deployment of digital health solutions in rural areas remains limited, with significant gaps in training, infrastructure and interdisciplinary collaboration. While modular models of online learning and training of trainers are promising, systemic barriers persist, including legal, economic and technological challenges. Similarly, Hutto and Wheeler (2021) stresses the crucial role of digital inclusion, stressing that insufficient access to broadband and outdated technologies continue to hinder the equitable deployment of telemedicine and related health innovations.

To meet these challenges, patients have to travel long distances. Therefore, rural healthcare leadership must promote the uptake and integration of telemedicine solutions as part of a broader strategy to improve accessibility and ensure continuity of care.

Partnerships with academic institutions, especially university hospitals, play a key role in addressing labour shortages in rural areas. These institutions act as training and mentoring centers, connecting medical students and young professionals with hands-on experiences in rural healthcare settings. Such collaborations not only increase the capacity of the workforce, but also deepen the understanding of the unique challenges and needs of rural populations.

For example, Calvin et al. (2023) emphasized that the implementation of academic ranks within rural community practices significantly supports educational programs while increasing physician satisfaction, recruitment, and retention. In addition, Mixer et al. (2021). demonstrated the value of academic-practice partnerships in preparing health workers for disadvantaged populations, highlighting the importance of interprofessional education, leadership development, and collaborative training programs. Similarly, Johnston et al. (2018) outlined recommendations for strengthening relationships between academic departments of emergency medicine and rural health facilities, highlighting the need for joint projects, tailored training opportunities, and culturally sensitive engagement strategies.

Figure no. 2 The VOSviewer analysis of the Web of Science dataset



Source: Authors' own based on literature review using VOSviewer

In Figure 2 we can see that leadership emerged as a pivotal theme, highlighting its role in addressing workforce shortages and improving healthcare service delivery. Studies, such as those by Bond and Chong (2020), underline the importance of tailored leadership training programs for rural healthcare professionals. These initiatives focus on fostering leadership capacity, enhancing governance, and promoting community engagement to better align with the unique challenges faced by rural areas (Bond and Chong, 2016).

Our analysis is addressing a all-around approach, where leadership integrates technological advancements, advocates for equitable policies, and encourages cross-sector collaboration. By bridging the gaps in workforce development and resource allocation, these strategies pave the way for sustainable improvements in healthcare delivery within rural settings.

5. Conclusions

Our results suggest that effective leadership in rural healthcare requires a multi-level approach that combines robust public policies, resource allocation, training and education initiatives, and innovative technological solutions. Leadership is essential not only to sustain these resources, but also to create and maintain systems that support the provision of sustainable healthcare in rural areas. Addressing these challenges requires coordinated efforts across sectors to ensure that healthcare accessibility, workforce development and patient care remain a priority in rural healthcare policy and practice.

Several limitations are present in this research. Firstly, only articles published in English were included, potentially excluding relevant studies in other languages. In addition, literature on rural areas has been relatively scarce, with most studies focusing on healthcare settings in developed countries such as the United States, Canada, and Australia, along with certain regions in China and Africa. This geographic concentration may limit the overall applicability of the findings to other rural areas with different healthcare challenges and contexts. These limitations suggest the need for further research covering a wider range of rural regions to gain a more comprehensive view of the role of management in addressing health labour shortages.

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Prevalence of Burnout in the Healthcare System and the Role of Work Management in Prevention

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Abstract

Burnout in the healthcare system is a major concern, significantly impacting both the staff and the quality of services provided. This article examines the prevalence of burnout among healthcare professionals, exploring environmental and personal factors that contribute to this issue. It also highlights the role of effective work management in preventing and reducing burnout. Through the analysis of case studies and management strategies, it demonstrates how optimizing working conditions can mitigate the risks associated with burnout, promoting a healthy and sustainable work environment in the healthcare sector. This article offers recommendations for integrating work management into prevention strategies.

Key words: burnout, healthcare system, work management, prevention strategies

J.E.L. classification: I12, J81, M54, I18

1. Introduction

The increasing concerns surrounding burnout within the healthcare workforce have raised significant alarms. Burnout, characterized by emotional exhaustion, depersonalization, and reduced personal accomplishment, has become a pressing issue with profound consequences for healthcare professionals and patients alike.

In this article, we delve into the prevalence of burnout within the healthcare system, shedding light on its scope and impact. We embark on a journey to dissect the contributing factors to the prevalence of burnout, scrutinizing both environmental and occupational factors and individual attributes that may render healthcare workers more susceptible.

Furthermore, we explore the pivotal role of ergonomics in combating burnout. Ergonomics, the science of designing and arranging environments and products to fit the individuals who use them, emerges as a key solution to prevent and mitigate burnout. We will discuss how ergonomics can be integrated into medical practice to optimize workspaces, improve work-life balance, and ultimately enhance the well-being and professional performance of healthcare professionals. (Ballou, 1992)

Through case studies and real-world examples, this article aims to demonstrate the tangible impact of ergonomics as a proactive strategy in the battle against burnout in the healthcare sector.

2. Theoretical background. Prevalence of burnout in the healthcare system

2.1. Clarifying the burnout phenomenon and its relevance in the medical context

Burnout, a multifaceted psychological syndrome characterized by emotional exhaustion, depersonalization, and a diminished sense of personal accomplishment, has become increasingly prevalent in the healthcare industry. Understanding its precise definition and relevance in the medical context is essential to addressing its impact on healthcare professionals and patient care.

The concept of burnout was first introduced by psychologists Herbert Freudenberger and Christina Maslach in the 1970s. Freudenberger, who was the first to describe burnout among healthcare workers, and Maslach, who later developed the Maslach Burnout Inventory (MBI), laid

the groundwork for understanding this syndrome as a response to chronic work-related stress, particularly in high-stakes professions such as healthcare. Burnout encompasses feelings of chronic fatigue, cynicism, and a reduced sense of efficacy among individuals in high-stress professions, such as medicine. (Bays, 2022, p.4)

In the medical field, burnout is particularly relevant due to the demanding nature of healthcare work. Physicians, nurses, and other healthcare professionals often face long hours, high patient caseloads, and emotionally charged situations. These stressors can lead to the development of burnout, which, in turn, can result in negative consequences, both for the healthcare worker and the quality of patient care. Within the medical context, burnout assumes heightened significance due to the unique challenges healthcare professionals face. These challenges encompass long and emotionally taxing work hours, the weight of patient care responsibilities, and the need to navigate intricate ethical and emotional terrains. These factors serve as fertile ground for the development of burnout, which can, in turn, cast a shadow over healthcare professionals' lives and detrimentally affect patient care quality. (Gromova et. al., 2016, p. 2)

Burnout has significant implications not only for the mental health and well-being of healthcare professionals but also for patient outcomes and the overall functioning of healthcare systems. Research has consistently shown that burnout among healthcare providers is associated with higher rates of medical errors, lower patient satisfaction, and increased turnover rates among healthcare staff. For example, a study by Shanafelt et al. (2012) found that physicians experiencing burnout are more likely to report major medical errors, suggesting a direct link between burnout and compromised patient safety. (Leitner & Cooper, 2023, p.15)

Furthermore, burnout contributes to the high turnover rates in healthcare, leading to staffing shortages and increased workloads for remaining staff, thereby perpetuating a vicious cycle of stress and burnout. This is particularly concerning in specialties such as emergency medicine, oncology, and critical care, where the emotional and physical demands are especially high. In these settings, burnout can lead to reduced empathy and compassion, as healthcare providers become increasingly depersonalized, viewing patients as mere tasks rather than individuals in need of care.

The triad of burnout manifests in distinct ways. Emotional exhaustion, the core component, envelops individuals in an overwhelming sense of chronic fatigue, making them feel drained and ill-equipped to handle the emotional demands intrinsic to healthcare work. This emotional depletion is often accompanied by physical symptoms, such as headaches and sleep disturbances, further exacerbating the individual's inability to cope with their workload. (Samusevica & Striguna, 2023, p.13)

Depersonalization, another dimension of burnout, leads to the dehumanization of patients. Healthcare providers experiencing this aspect of burnout often adopt a detached and cynical outlook, treating patients as objects or problems to be solved rather than individuals with unique needs and concerns. This detachment not only undermines the quality of patient care but also contributes to a sense of isolation and disconnection among healthcare professionals. (Lyon TR, Galbraith A., 2023)

Simultaneously, the reduced sense of personal accomplishment permeates the third facet of burnout. Healthcare workers may feel as though their efforts yield little tangible impact, eroding their self-esteem and professional motivation. This lack of fulfillment can be particularly devastating in the medical field, where many professionals enter the field with a strong sense of purpose and desire to help others. (Moss, 2021, p.31)

The consequences of burnout extend beyond the individual healthcare worker, affecting entire healthcare systems. Burnout is associated with higher absenteeism, reduced productivity, and increased costs for healthcare organizations. Additionally, the emotional toll of burnout can lead to more serious mental health issues, such as depression and anxiety, which may require long-term treatment and support.

By recognizing the significance of burnout in the medical context, healthcare institutions can take proactive measures to support their staff, enhance well-being, and ultimately ensure the delivery of high-quality healthcare services. This involves not only addressing the immediate symptoms of burnout but also tackling the root causes. Strategies such as improving work-life balance, offering mental health support, and promoting a culture of resilience and teamwork can help mitigate the impact of burnout.

Moreover, research suggests that organizational interventions, such as reducing workload, increasing job control, and fostering a supportive work environment, can significantly reduce burnout levels. For example, a study by West et al. (2016) highlights the importance of leadership in preventing burnout, emphasizing that leaders who prioritize the well-being of their staff and create a positive work culture can help reduce burnout rates. (Mayer, 2021, p.12)

2.2. Current statistics: Prevalence of burnout among physicians and nurses, including trends and regional variations

Understanding the prevalence of burnout within the medical field is essential to grasp the full extent of this issue. To shed light on the gravity of the situation, we turn to real-world statistics that depict the sobering reality healthcare professionals face. (Kristensen et al., 2005, p.193)

Recent data underscores the alarming prevalence of burnout among physicians, nurses, and healthcare staff. According to a comprehensive study conducted in the United States by the National Academy of Medicine, an estimated 42% of physicians experience burnout at some point in their careers. Furthermore, the study found that this phenomenon is not limited to one specific medical specialty, affecting healthcare professionals across various disciplines. (Lyon & Galbraith, 2023, p.2715)

Similarly, a survey conducted by the American Nurses Association revealed that approximately 33% of nurses reported experiencing burnout, with nearly 40% considering leaving the profession as a result. These statistics highlight the widespread nature of burnout among healthcare workers and its potential ramifications on the nursing workforce. (Lyon & Galbraith, 2023, p.2715)

Internationally, the situation is no less concerning. In the United Kingdom, a survey conducted by the British Medical Association in 2020 found that 48% of doctors reported experiencing burnout, with the COVID-19 pandemic exacerbating these feelings of exhaustion and stress. (Lyon & Galbraith, 2023, p.2715)

The consequences of burnout extend beyond individual healthcare professionals to impact patient care and healthcare systems as a whole. Research published in the *Journal of General Internal Medicine* revealed that physicians experiencing burnout are more likely to make medical errors, compromising patient safety.

Moreover, burnout contributes to high turnover rates within the healthcare workforce, exacerbating existing shortages and placing additional strain on healthcare systems worldwide.

These real-world statistics serve as a stark reminder of the urgency to address burnout within the medical field. The prevalence of burnout not only affects the well-being of healthcare professionals but also jeopardizes the quality of patient care. It is imperative that healthcare institutions and policymakers take proactive measures to mitigate burnout's impact and ensure the sustainable functioning of healthcare systems.

According to a Medscape Physician Lifestyle Report, in 2021, 51% of physicians reported experiencing burnout. This figure has steadily increased over the years, highlighting the persistent nature of the problem within the medical community. Moreover, a MedPage Today survey found that burnout rates vary by specialty, with critical care and emergency medicine physicians reporting some of the highest rates, exceeding 60%. (Lyon & Galbraith, 2023, p.2716)

The American Nurses Association's 2021 Health Risk Appraisal reported that 49% of nurses experienced symptoms of burnout. This statistic is particularly concerning as nurses are at the frontline of patient care and play a pivotal role in healthcare systems.

Burnout is a global issue. In a study published in *JAMA Surgery* in 2020, researchers found that 36% of surgeons across 29 countries reported experiencing burnout. This indicates that burnout is not limited to a specific healthcare system or region. (Lyon & Galbraith, 2023, p.2716)

Burnout can have dire consequences for patient care. A study published in *Mayo Clinic Proceedings* in 2019 revealed that burned-out physicians were twice as likely to report a major medical error within the past three months.

3. Research methodology

This study investigates the prevalence of burnout among healthcare professionals and evaluates the role of work management strategies, particularly ergonomics, in mitigating burnout within the healthcare system. It focuses on identifying key contributors to burnout and exploring how targeted interventions can improve the well-being of healthcare staff and the quality of care provided. The central research question is:

What is the impact of work management and ergonomic interventions on mitigating burnout among healthcare professionals, and how can these strategies be effectively implemented within healthcare settings?

To address this question, the study tests the following 3 hypotheses:

H1: Implementing ergonomic interventions in healthcare workplaces significantly reduces emotional exhaustion among healthcare professionals.

H2: Effective work management strategies, including structured scheduling and balanced task delegation, decrease depersonalization and improve team cohesion.

H3: Personal characteristics, such as emotional intelligence and resilience, moderate the effectiveness of work management interventions in reducing burnout levels.

Cause-Effect Analysis- This method identifies and analyzes the relationship between workplace stressors and burnout indicators. Key variables include excessive workloads, insufficient rest periods, and poor task delegation. By mapping these relationships, the study evaluates how specific ergonomic and management interventions can mitigate burnout symptoms.

SWOT Analysis- This approach examines the strengths, weaknesses, opportunities, and threats of current work management and ergonomic practices within healthcare organizations. It provides insights into areas for improvement, such as addressing staffing shortages and enhancing access to mental health resources.

These methodologies allow for a comprehensive understanding of the factors contributing to burnout and the role of work management and ergonomics in prevention. Data from surveys, case studies, and existing research inform evidence-based recommendations for healthcare organizations to implement targeted strategies for reducing burnout. (Maslach et. al, 2001, p.398)

4. Analyzing workplace contributors to high burnout levels

4.1. Environmental and occupational factors

In the relentless pursuit of understanding burnout and its prevalence among healthcare professionals, it is imperative to scrutinize the environmental and occupational factors that serve as potential breeding grounds for this pervasive phenomenon.

Healthcare workplaces, by their very nature, can incubate conditions ripe for burnout. The demanding, high-stress environment characterized by long work hours, emotionally charged patient interactions, and frequent exposure to life-and-death decisions can take a toll on the mental and emotional well-being of healthcare professionals.

Workload is a critical factor. Excessive patient caseloads, administrative burdens, and the pressure to meet stringent performance metrics can overwhelm healthcare workers, leaving them emotionally drained and fatigued. Moreover, inadequate staffing levels exacerbate the problem, forcing healthcare professionals to do more with less.

The lack of control and autonomy in decision-making can compound stress. Healthcare workers often find themselves navigating complex bureaucracies and adhering to rigid protocols, which can erode their sense of agency and efficacy.

Interpersonal dynamics and workplace culture play a pivotal role. Instances of workplace incivility, lack of collegial support, and a failure to address the emotional toll of patient care can contribute to feelings of depersonalization and cynicism.

Burnout is further fueled by the electronic health record (EHR) systems, which, although intended to enhance patient care, often result in additional administrative burdens. Healthcare professionals spend a significant portion of their time on EHR documentation, detracting from direct patient care and exacerbating their workload. (West et al., 2016)

The relentless pace of healthcare, coupled with the ever-evolving demands of modern medicine, necessitates a thorough exploration of these environmental and occupational factors contributing to burnout. Recognizing these factors is the first step in developing comprehensive strategies to mitigate burnout's impact and foster the well-being of healthcare professionals.

To comprehend the stark reality of burnout among healthcare professionals, it is essential to delve deeper into quantitative data that paints a vivid picture of the environmental and occupational factors amplifying this predicament.

The impact of workload cannot be overstated. A study conducted by the National Institute for Occupational Safety and Health (NIOSH) in the United States found that 82% of healthcare workers reported significant work-related stress. This stress is compounded by long work hours, with data from the U.S. Bureau of Labor Statistics revealing that nurses, on average, work 12-hour shifts, often leading to exhaustion and emotional strain.

Inadequate staffing levels are a pervasive issue. A survey by the American Association of Critical-Care Nurses found that 54% of nurses believed their units were understaffed, resulting in increased workloads and heightened stress levels.

Electronic health record (EHR) systems, intended to streamline patient care, have inadvertently contributed to burnout. Research published in the *Journal of General Internal Medicine* in 2021 reported that physicians spend, on average, 16 minutes on EHR documentation for every patient encounter. This administrative burden detracts from direct patient care, leading to heightened stress.

Interpersonal dynamics play a critical role. A study published in the *Journal of Healthcare Management* found that 67% of healthcare workers reported experiencing workplace incivility, which can contribute to feelings of depersonalization and cynicism.

These quantitative data points underscore the magnitude of the challenges healthcare professionals face within their work environments. Understanding the real-world impact of these factors is crucial for developing targeted interventions that address the root causes of burnout and provide meaningful support to those on the frontlines of healthcare.

4.2 Individual factors - Discussing personal characteristics that can increase exposure to burnout

Burnout in the healthcare sector is influenced not only by external factors such as workload and organizational demands but also by individual characteristics that can make certain healthcare professionals more susceptible to this syndrome. Understanding these individual factors is crucial for developing personalized strategies to prevent and manage burnout.

One of the most significant individual factors contributing to burnout is **perfectionism**. Many healthcare professionals, particularly physicians and nurses, enter the field with high expectations of themselves and their work. While striving for excellence is commendable, perfectionism can lead to unrealistic self-expectations, where any deviation from perceived perfection is seen as a failure. This constant pressure to perform flawlessly can cause chronic stress, leading to emotional exhaustion and burnout. Studies have shown that healthcare professionals with perfectionist tendencies are more likely to experience burnout, as they may struggle to cope with the inevitable challenges and uncertainties that arise in medical practice.

Personality traits also play a critical role in burnout susceptibility. For example, individuals with Type A personalities—characterized by competitiveness, impatience, and a high degree of self-drive—are more prone to burnout due to their intense work ethic and propensity to overcommit. These individuals may find it difficult to delegate tasks or take breaks, leading to chronic overwork and stress. On the other hand, healthcare workers who are more resilient and possess a positive outlook are better equipped to handle stress and are less likely to experience burnout.

Emotional intelligence (EI) is another crucial factor that influences burnout risk. Healthcare professionals with high emotional intelligence are better at managing their own emotions and empathizing with others, which can protect against burnout. They can maintain a healthy emotional distance from their work, avoiding the excessive emotional involvement that can lead to depersonalization. Conversely, those with lower emotional intelligence may struggle to manage the emotional demands of patient care, increasing their risk of burnout.

Work-life balance is an individual factor that can significantly impact burnout levels. Healthcare professionals who have difficulty balancing their professional responsibilities with personal life are more likely to experience burnout. This imbalance often leads to prolonged periods of stress without adequate recovery time, contributing to both emotional and physical exhaustion. Personal circumstances, such as family responsibilities or lack of social support, can exacerbate this imbalance, making it more challenging for individuals to manage stress effectively.

5. Findings. The importance of work management and the integration of ergonomics in preventing burnout

Work management plays a crucial role in determining stress levels and, consequently, in either preventing or exacerbating burnout among healthcare professionals. In a highly demanding work environment like healthcare, effective work management is not only essential for ensuring productivity but also for protecting the mental and emotional well-being of employees. Poor work management, characterised by excessive workloads, lack of organisational support, and inefficient communication, can significantly contribute to the development of burnout. Conversely, proper work management, which includes stress-reduction strategies and the promotion of a balanced work environment, can act as a protective factor against burnout.

Burnout often results from an imbalance between professional demands and the resources available to meet those demands. Effective work management involves not just the appropriate distribution of tasks and responsibilities but also ensuring that staff have access to the resources they need to complete their work without compromising their mental health. For instance, scheduling work hours, managing patient loads, and providing support for professional development are key elements that can directly influence the level of burnout experienced by healthcare staff.

Ergonomics, as a discipline focused on optimising the interaction between people and their work environment, plays a critical role in preventing burnout by improving working conditions and reducing physical and mental stressors. Integrating ergonomic principles into work management means adapting tasks and workspaces to the needs and capabilities of healthcare professionals, thus reducing the risk of burnout.

In practice, this might involve designing workspaces that reduce physical strain, such as adjustable furniture and equipment, or implementing workflow processes that minimise repetitive tasks and allow for adequate rest periods. Ergonomics also addresses cognitive load by ensuring that tasks are not only physically manageable but also mentally sustainable. By designing work environments that reduce unnecessary stress and fatigue, ergonomics can help mitigate some of the key factors that lead to burnout.

Furthermore, ergonomic interventions often go hand in hand with broader work management strategies aimed at promoting well-being. For example, incorporating regular breaks, providing mental health resources, and fostering a supportive work culture are all part of a holistic approach that integrates ergonomic principles. This not only improves job satisfaction but also enhances the overall resilience of healthcare professionals against burnout.

5.1. The relevance of work management concepts in the medical field

Work management is a critical aspect of organisational success, especially in high-pressure environments such as healthcare. The complexity of healthcare settings, characterised by the need to balance patient care, administrative duties, and personal well-being, makes the implementation of effective work management strategies essential. This section delves into the relevance of work management concepts in medicine, exploring how these strategies can enhance both the efficiency and well-being of healthcare professionals.

Work management in healthcare involves coordinating various tasks, responsibilities, and resources to achieve optimal patient outcomes while maintaining the health and efficiency of healthcare workers. Unlike many other industries, the stakes in healthcare are exceptionally high, as the well-being of patients directly depends on the effectiveness of the healthcare system. Poor work management can lead to burnout, reduced job satisfaction, and ultimately, compromised patient care.

The relevance of work management in medicine is multifaceted. It includes scheduling, task allocation, resource management, and ensuring that healthcare professionals have the necessary support to perform their duties effectively. A well-managed work environment allows healthcare workers to focus on patient care without the added stress of overwhelming workloads or inadequate resources. This is particularly important in settings such as hospitals, where the workload is often unpredictable, and the emotional and physical demands on staff are significant.

Several work management concepts are particularly pertinent to the healthcare sector. One of the most critical is **task delegation**. In a medical setting, effective delegation ensures that tasks are distributed according to the expertise and capacity of the staff. This not only optimises efficiency but also helps prevent burnout by ensuring that no single individual is overloaded with responsibilities. For example, routine tasks can be assigned to junior staff or administrative personnel, allowing senior medical professionals to focus on more complex patient care activities.

Another important concept is **time management**. The ability to manage time effectively is crucial in healthcare, where delays can have serious consequences. Time management strategies, such as prioritizing tasks, setting realistic deadlines, and avoiding multitasking, can significantly improve the workflow in medical settings. Moreover, good time management allows for better work-life balance, reducing the risk of burnout among healthcare professionals.

Resource management is also vital in healthcare. This involves the efficient use of both human and material resources. In a medical context, this could mean ensuring that there are enough staff on hand to meet patient demand, that medical equipment is available and functioning correctly, and that supplies are adequately stocked. Poor resource management can lead to bottlenecks, increased stress, and ultimately a decline in the quality of patient care.

Communication is another key aspect of work management. Clear, efficient communication within healthcare teams is essential for coordinating patient care, particularly in high-pressure environments such as emergency departments or operating theatres. Effective communication helps prevent errors, reduces misunderstandings, and ensures that all team members are on the same page regarding patient care plans. Additionally, fostering a culture of open communication can help identify potential problems before they escalate, allowing for timely interventions and adjustments in the workflow.

The application of effective work management strategies in healthcare can have a profound impact on both the well-being of healthcare professionals and the quality of patient care. When tasks are well managed, healthcare workers experience less stress and are more likely to maintain high levels of job satisfaction. This, in turn, leads to better patient care, as professionals who are not overwhelmed by their workload can focus more on their patients' needs.

Moreover, effective work management can help reduce the incidence of medical errors. Research has shown that burnout and stress are major contributors to mistakes in healthcare settings. By implementing strategies that manage workloads, reduce unnecessary stress, and improve time management, healthcare organizations can create an environment where staff can perform at their best, thus enhancing patient safety and outcomes.

5.2. Work management in reducing the risk of burnout

Work management plays a pivotal role in mitigating the risk of burnout among healthcare professionals. Given the demanding nature of the medical field, where long hours, high patient loads, and emotionally charged situations are common, effective work management is essential in creating a sustainable and healthy work environment.

One of the primary ways work management reduces burnout is through **balanced workload distribution**. By ensuring that tasks are allocated according to the capacity and expertise of each team member, healthcare organizations can prevent individuals from becoming overwhelmed. This approach not only helps in managing physical exhaustion but also addresses emotional fatigue, as staff are less likely to experience the chronic stress that leads to burnout.

Structured scheduling is another critical aspect of work management. Implementing regular shifts with appropriate breaks and ensuring that healthcare professionals have sufficient time off between shifts can significantly reduce the risk of burnout. Adequate rest is essential for maintaining

both physical and mental health, and structured schedules help in preventing the cumulative fatigue that often contributes to burnout.

Moreover, **supportive leadership** is integral to effective work management. Leaders who prioritize the well-being of their teams by fostering open communication, offering emotional support, and providing resources for stress management create an environment where burnout is less likely to occur. Supportive leadership also includes recognizing signs of burnout early and intervening with appropriate measures, such as adjusting workloads or offering additional support.

Finally, work management strategies that encourage **professional development and autonomy** can reduce burnout by enhancing job satisfaction. When healthcare professionals feel empowered to make decisions and are given opportunities to grow in their roles, they are more likely to remain engaged and motivated, reducing the likelihood of burnout.

6. Qualitative analysis regarding the impact of work management principles on burnout in the healthcare sector

6.1. Cause-effect Analysis

CAUSE	EFFECT
1. excessive workload: when healthcare professionals are overwhelmed with an unmanageable number of tasks and patient cases, it leads to chronic stress and fatigue.	1. increased burnout rates: excessive workload directly correlates with higher burnout rates, leading to emotional exhaustion and decreased job satisfaction.
2. inefficient task delegation: poor delegation can result in some staff members being overburdened while others are underutilized, leading to unequal stress distribution.	2. reduced team cohesion: inefficient task delegation can create tension and resentment among staff, weakening team dynamics and increasing stress.
3. lack of autonomy: healthcare professionals who feel they have little control over their work processes are more likely to experience frustration and emotional exhaustion.	3. lower job satisfaction: a lack of autonomy often results in healthcare professionals feeling undervalued and disengaged, which lowers overall job satisfaction.
4. inadequate rest periods: insufficient breaks and long shifts without adequate recovery time contribute to physical and mental exhaustion.	4. physical and mental health decline: inadequate rest periods contribute to both physical and mental health issues, exacerbating burnout symptoms.
5. poor communication: ineffective communication within healthcare teams can create confusion, increase stress, and lead to errors, all of which contribute to burnout.	5. higher error rates: poor communication increases the likelihood of mistakes in patient care, which not only endangers patients but also heightens stress and burnout among staff.
6. lack of supportive leadership: when leadership fails to provide adequate support and resources, healthcare professionals may feel isolated and overwhelmed.	6. decreased retention rates: without supportive leadership, burnout can lead to higher turnover rates as healthcare professionals retire due to unsustainable work conditions.

6.2. S.W.O.T Analysis

<p style="text-align: center;">STRENGTHS</p> <ol style="list-style-type: none"> 1. There is a growing body of research focused on understanding burnout in healthcare. Studies show that over 50% of physicians in the U.S. experience burnout, which has led to greater awareness and prioritization of effective work management practices. 2. Many healthcare organizations are beginning to adopt leadership strategies that focus on staff well-being, leading to reduced burnout rates. For example, organizations that employ supportive leadership have reported up to a 20% reduction in staff turnover, according to a 2019 report by the American Medical Association. 3. The integration of electronic health records (EHRs) and other health IT solutions has streamlined administrative tasks, potentially reducing workload and stress, contributing to lower burnout rates. 4. Many healthcare organizations are increasingly investing in employee well-being initiatives, such as flexible work schedules and mental health resources. According to a 2021 survey by the American Hospital Association, 75% of hospitals have implemented well-being programs that have contributed to a 10-15% reduction in burnout. 5. By offering continuous education and professional growth opportunities, healthcare organizations can enhance job satisfaction and reduce burnout. A study by the Institute for Healthcare Improvement (IHI) found that healthcare professionals with access to regular training and development programs reported 20% lower burnout rates. 	<p style="text-align: center;">WEAKNESSES</p> <ol style="list-style-type: none"> 1. Despite technological advancements, many healthcare professionals still face excessive workloads. The AMA reports that physicians spend nearly twice as much time on administrative tasks as they do on patient care, contributing to high levels of burnout. 2. There is a lack of standardization in how work management strategies are implemented across healthcare institutions, leading to varying levels of effectiveness in reducing burnout. 3. Some healthcare professionals and administrators are resistant to changing established work routines, which can impede the adoption of more effective work management practices. 4. Despite the growing awareness, many healthcare workers still lack access to adequate mental health support. A survey by Medscape in 2021 revealed that only 39% of physicians felt they had access to the mental health resources they needed, contributing to higher burnout rates. 5. Persistent understaffing issues force existing staff to work overtime, leading to increased stress and exhaustion. A report by the U.S. Department of Health and Human Services (HHS) found that 60% of nurses work beyond their scheduled hours, significantly increasing their risk of burnout.
<p style="text-align: center;">OPPORTUNITIES</p> <ol style="list-style-type: none"> 1. There is an opportunity to influence healthcare policy at the institutional and governmental levels to mandate better work management practices, which could standardize efforts to reduce burnout across the sector. 2. Utilizing big data analytics can help healthcare organizations identify specific factors contributing to burnout and tailor interventions accordingly. For instance, targeted workload adjustments based on real-time data have been shown to reduce burnout by up to 15% in certain settings. 3. Expanding wellness programs that focus on mental health, resilience training, and work-life balance can significantly reduce burnout rates. Organizations with robust wellness programs report up to 30% lower burnout rates, according 	<p style="text-align: center;">THREATS</p> <ol style="list-style-type: none"> 1. Ongoing shortages of healthcare professionals exacerbate workload issues, leading to higher burnout rates. According to the Association of American Medical Colleges (AAMC), the U.S. could face a shortage of up to 139,000 physicians by 2033, which could worsen burnout unless effective work management practices are widely adopted. 2. COVID-19 pandemic has heightened stress levels in healthcare, with burnout rates rising by up to 20% among healthcare workers. 3. Budget cuts and financial pressures on healthcare institutions may limit the ability to implement necessary work management improvements, thereby increasing the risk of burnout.

<p>to a 2020 study by the National Academy Of Medicine (U.S.).</p> <p>4. The adoption of telemedicine and remote work options offers healthcare professionals more flexibility, potentially reducing stress and burnout. According to a 2020 report by McKinsey, organizations that implemented telemedicine saw a 25% improvement in work-life balance for healthcare providers.</p> <p>5. Implementing cross-training programs allows healthcare professionals to diversify their skills, reducing monotony and enhancing job satisfaction. The British Medical Journal (BMJ) reported that cross-trained healthcare teams exhibited 15% lower burnout rates compared to their peers.</p>	<p>4. Increasing regulatory requirements and compliance burdens can add to the administrative workload of healthcare professionals, exacerbating burnout. A 2021 study published in <i>Health Affairs</i> found that regulatory tasks accounted for 30% of physicians' time, contributing significantly to burnout.</p> <p>5. The rapid adoption of new technologies, while beneficial in many ways, can also lead to technological fatigue. A 2020 survey by Stanford Medicine revealed that 40% of physicians reported feeling overwhelmed by the demands of learning and adapting to new healthcare technologies, which can contribute to burnout.</p>
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7. Conclusions

The prevalence of burnout in the healthcare sector underscores the urgent need for effective work management strategies to safeguard the well-being of healthcare professionals and ensure the quality of patient care. Burnout, driven by excessive workloads, inadequate rest, and poor support systems, not only impacts the mental and physical health of healthcare workers but also compromises patient safety. By integrating principles of work management—such as balanced task distribution, structured scheduling, and supportive leadership, healthcare organizations can significantly reduce burnout rates.

Furthermore, these strategies must be tailored to address both organizational and individual factors contributing to burnout. Effective work management fosters a supportive environment that promotes resilience, job satisfaction, and a sustainable work-life balance. As the demands on healthcare systems continue to intensify, it is imperative that these strategies are implemented and continually refined. In doing so, healthcare institutions can mitigate the detrimental effects of burnout, ultimately leading to better outcomes for both healthcare professionals and the patients they serve.

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Implementing and Institutionalizing Organizational Change: Key Steps in Change Management – An Empirical Study in a Multinational IT&C Company

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Abstract

Numerous specialists argue that the current rate of organizational transformation is unparalleled, with businesses evolving more rapidly than at any point in history. Major organizational change is challenging, as the stakes involved are generally very high and the time available for implementation is still limited.

Simultaneously, the success rates of significant organizational change initiatives remain surprisingly low, even when considerable effort is invested, which is driving change management to become increasingly comprehensive and systematic, flexible and adaptive.

In this study, we aim to identify and analyze the key factors that influence the effectiveness of initiating, planning and implementing change in business environment companies, along with the change management practices that facilitate the institutionalization of change, as exemplified steps in an IT&C company.

Key words: organizational change, change management, implementation, institutionalizing change

J.E.L. classification: M10, M15

1. Introduction

Organizations and their leaders are also changing as a natural response to strategically important shifts, from effective management of markets to innovation to knowledge and human resource management (Burnes, 2015). Many change management approaches and methods have emerged as a result of significant changes in their structure, systems, strategies and human resources. Organizations increasingly need an integrated approach to implement systematic and constructive change.

Successfully implementing organizational change necessitates a structured approach, designed to enhance the effectiveness of change execution within a complex and ever-evolving business environment (King *et al*, 2020).

In the last decade organizational change is experiencing increasing frequencies and increasing complexity, which is why companies in the business environment need to take into account the following trends (Harrington, 2018):

- increasing the importance of knowledge management;
- the development of increasingly sophisticated information and communication technologies;
- increased cognitive skills requirements;
- developing new, increasingly flexible structures, virtual organizations, networks and alliances;
- Increasing the number of mergers, acquisitions, sectoral consolidation;
- increasing changes in organizational culture (Harrington, 2018)

Organizational change encompasses a wide range of phenomena and processes very different in scope and specificity, among which the most common are: restructuring; reengineering; reorganization; performance management; redesign of supply chains; mergers and acquisitions; changes in organizational culture to ensure the transformation of employee mindset, etc (Kotter, 2007).

Organizations, irrespective of size, type of organization and field of activity, face two broad categories of factors/forces that determine the need for change, namely external and internal factors. Company managers, in order to facilitate the effective implementation of change to achieve the expected tangible results must ensure realism and clarity in:

- setting objectives to be achieved;
- the strategies needed to achieve them;
- organizational planning, structures and systems (Hackman, *et al*, 2010).

2. Literature review

To be successful, companies operating in an increasingly dynamic business environment with frequent states of uncertainty need to change more and more than companies operating in a less dynamic business environment with a higher degree of stability (Kim & Scott, 2019).

In order to implement change at the organizational level, the specifics of the interventions required for organizational change must be understood. At this stage the change coordinating committee implements the planned change initiative.

Company management implements change by:

- implementing change processes that ensure the delivery of the results expected by the company;
- preparing the organization for change by identifying and implementing supporting activities;
- involving and informing relevant stakeholders about the ultimate objectives of the change,
- assessing the active involvement of relevant stakeholders in decisions about change;
- delivery of the products/services and results of change initiatives (Glew, *et al*, 1995).

If changes, however small, are not implemented effectively, based on a precise timetable, it will be difficult to gain the acceptance of key stakeholders. For this reason the process of change should be monitored, and relevant participants and stakeholders should be informed of the results achieved. It is also important to encourage the promotion of an organizational climate where issues are discussed openly (Stacey & Mowles, 2016).

Regardless of the scale and speed of organizational change, businesses must establish clear goals and standards for the change process while fostering motivation among all stakeholders—both those directly involved in the process, those indirectly engaged, and those impacted by the changes. Simultaneously, organizations must ensure that all participants exhibit attitudes and behaviors that support the effective planning and execution of change initiatives (Kotter, 2007).

Based on the challenges and circumstances faced by an organization to which we can add those caused by the implementation of organizational change, which can provide significant benefits, Kim and Scott (2019) highlight three key factors that determine the effectiveness of implementing organizational change, namely:

- *Stakeholders* with specific roles and responsibilities throughout the organizational change process: top-managers; middle and junior managers; change manager; training/performance analysts; human resources; employees; management information services; other stakeholders (change steering committee, financial expert; communication specialist; organizational development expert, etc.).
- *The change process for change initiatives at the organizational level*, comprises: assessment; implementation; development; design; analysis; evaluation; planning.
- *Communication*: gathering information; disseminating information.

Company leadership implements change by:

- operationalizing the change processes that ensure the delivery of expected company results;
- preparing the organization for change by identifying and implementing supporting activities;

- Mobilizing and informing stakeholders about the (ultimate) objectives of change and ensuring their active participation in decisions affecting change;
- Delivering the products/services and results of change initiatives.

According to many authors and practitioners, the human dimension of the change process is the most important of the critical success factors in effective implementation of organizational change, and that must be manifested in employee feedback on the change (King *et al*, 2020).

3. Research methodology

This study aims to explore the critical success factors that significantly influence the success of the implementation and institutionalization of planned change in the investigated company, along with ensuring the effectiveness of change management practices, methods and techniques, in a multinational company from the IT&C industry in Romania.

Regarding the typology of the research used in this study, we mention that it is based on a quantitative research, with the questionnaire as an instrument that was used to assess the respondents' perceptions of the factors that determine the effectiveness of implementing change in the company analyzed.

For this purpose, the items that compose the questionnaire were evaluated on a Likert-type scale from 1 to 5 (1 - strongly disagree; 2 - disagree; 3 - undecided; 4 - agree; 5 - strongly agree).

The research was based on a sample of 187 managers and non-executive employees. The most relevant statistical variables we considered for the analysis are:

- Factors determining the effectiveness of change implementation - summarized by the statistical variable "*ECT*"
- Effectiveness of institutionalizing change - summarized by the statistical variable "*EIC*"

4. Results

Effectiveness of change implementation represented by the aggregate variable *ECI*, which expresses how well the change processes are operationalized, stakeholders are mobilized and informed about the objectives of the change and the delivery of the results achieved.

The *ECI* variable is composed of 19 primary variables which, in terms of reliability, present a good degree of internal consistency, with an Alpha Cronbach's Cronbach's coefficient of 0.9144, which demonstrates the correctness and relevance of its construct.

The analysis of the *ECI* variable, based on descriptive statistics indicators, shows that it registers a mean of 4.0521, and a standard deviation (sd) of .4155, considered good.

Table no. 1 CIS, statistics(count mean sd semean cv) columns(statistics)

Variable	N	Mean	SD	if(mean)	CV
ECI	187	4.052193	.415515	.0303855	.1025408

Source: Own research

The standard error se(mean) of .03038 indicates a good closeness of the mean of the *ECI* variable to its true value.

The coefficient of variation (cv) of 0.1025 expresses that the statistical population has a good degree of homogeneity.

Based on the structure of the *ECI* variable construct, we can identify the main factors and practices that contributed to the effectiveness of organizational change implementation, based on the information provided by the respondents through the questionnaire.

Among the most important primary variables composing the *ECI* aggregate variable construct, we mention the following:

- diagnosing change-related problems, 3.80745;
- developing the skills needed to make and effectively implement organizational change, 3.82887;
- leadership and change management skills, 3.88235;

- aligning action plans or interventions for change with organizational strategies, 4.16577;
- involving stakeholders in implementing change, 4.032086;
- ensuring the effectiveness of organizational change policies and practices, 4.08556;
- adopting the most appropriate strategies for maintaining control over company members' resistance to change 4.02673;
- data collection and analysis and feedback processes for implementing organizational change, 3.89304;
- delivering company results from change implementation processes, 3.91978;
- identification and implementation of support activities, 4.10695;
- active participation of relevant stakeholders in decisions affecting change, 4.02130.

The variables with the highest scores, which significantly influenced the aggregate *ECI* variable, refer to:

- align change objectives and policies with the company's strategic objectives;
- strengthening organizational cultures for successful implementation of change within the company;
- take prompt and effective decisions when the situation requires it;
- align action plans or interventions for change with organizational strategies;
- effective organization of change on the basis of an appropriate structure;
- making the employees of the organization aware of the need for change;
- adopting the most effective methods of support.

Knowledge of these factors is important for both managers and non-managerial employees, as they play an important role in ensuring trust in the leaders and in the results of the changes that are implemented in the company.

Based on an understanding of the key aspects of general practices in effecting organizational change, change management based on a systematic and effective approach involves not only planning, preparing and implementing change within the company, but also institutionalizing it.

At the same time, reinforcing the results of organizational change within the organization is a motivating factor that gives confidence to employees (Singh & Ramdeo, 2020).

The effectiveness of institutionalization of organizational change, represented by the aggregate variable *EIC*, expresses the need to consolidate the results of change implementation at the organizational level, within the company, through integration, recognition and review.

The *EIC* variable is composed of 16 primary variables which, in terms of reliability, present a good degree of internal consistency, with an Alpha Cronbach's Cronbach's coefficient of 0.8986, which demonstrates the correctness and relevance of its construct.

The analysis of the *EIC* variable, based on descriptive statistics indicators, shows that it registers a mean of 4.1024 and a standard deviation (sd) of .4543, considered good, in terms of the variation of the responses from the mean.

Table no. 2 *EIC*, statistics(count mean sd se mean cv) columns(statistics)

Variable	N	Mean	SD	se(mean)	CV
EIC	186	4.102419	.4543805	.0333168	.1107592

Source: Own research

Starting from the structure of the *EIC* variable construct we can identify the main factors and practices that contributed to ensuring the effectiveness of institutionalizing organizational change, based on the information provided by the respondents, of which we mention the following items:

- embedding and integrating change in the organization, 4.36021;
- recognizing and rewarding achievements, 3.93048;
- reviewing the change by making adjustments where necessary, 4.07951;
- providing appropriate training and practices to prepare company members to reinforce the changes implemented, 3.85026;
- recognizing the continuous and evolutionary nature of change, 4.26203;

- ensuring an appropriate motivation system for involvement and commitment to enhance change, 4.04812;
- focus on how to manage and adapt to the new conditions after implementing change, 4.01069;
- advocacy and support, through activities that go beyond the traditional scope of change projects and programs to be implemented, 4.02003;
- effective communication and consultation with relevant stakeholders, 4.08021;
- raising awareness and sensitizing employees to understand change processes and the need to implement change, 4.03743;
- benefits of change, 4.21925;

The variables with the most important contribution to ensuring the effectiveness of the institutionalization of implemented changes, which by the size of the average scores given by the respondents to the questionnaire, exceeds the average score of the aggregate variable, are as follows:

- embedding and integrating change in the organization;
- recognizing the continuous and evolutionary nature of change;
- identifying and communicating the benefits of change;
- providing feedback during the planning, development and implementation of changes within the company, which allows the identification of areas of activity where corrections/adjustments need to be made;
- taking corrective action if the review identifies gaps between the objectives achieved by implementing the change and the standards set in the plan for change;
- motivation and commitment to institutionalizing change that creates a sense of achievement and satisfaction;
- recognizing change initiatives and employees' contributions to reinforcing change.

In order to identify statistical relationships between the independent variable *ECI*, which express the factors influencing the effectiveness of organizational change within the company, and the dependent variable *EIC*, expressing the effectiveness of institutionalizing change, a simple linear regression statistical analysis was performed. Therefore, in Table 3 we aim to analyze the magnitude of influence that the independent variable *ECI* has on the dependent variable *EIC*.

Table no. 3 Regress *ECI EIC*, *vce(robust)*

Independent variable	N	Prob > F	Coefficient	Robust std. err	R-squared	t	P> t
ECI	186	0.0000	.8442421	.0511829	0.5959	16.49	0.000

Source: Own research

The *ECI* variable has a statistically significant impact on the *EIC* variable because the F-test has a p-value of 0.0000. The variation in the *ECI* variable explains 59.59% ($R^2 = 0.5959$) of the variation in the *EIC* variable. The coefficient of the *ECI* variable equals 0.8442 and is estimated with p-value = 0.000 ($P>|t| < 0.05$). The sign of the coefficient is positive, this means that for a one unit increase in the *ECI* variable, the *EIC* variable will increase by 0.8442 units.

In other words, we can say that for a one unit increase in the factors that determine the effectiveness of implementing change (*ECI*), the effectiveness of institutionalizing change (*EIC*) will increase by 0.8442 units.

We observe that the factors influencing the effectiveness of change implementation have a significant impact on the successful institutionalization of change within the organization.

5. Conclusions

Many experts believe that the level of organizational change is unprecedented, with organizations changing at a faster pace than ever before. Major organizational change is challenging, as the stakes involved are generally very high and the time available for implementation is still limited.

In this context the research uncovers and analyses the critical success factors that determine the effectiveness of organizational change, together with the practices, methods and techniques that ensure that the expected results are achieved (Burnes, 2015).

Additionally, it examines the impact of the factors affecting change implementation on the institutionalization of change within a multinational company operating in Romania's IT&C sector.

Organizations and their leaders are also changing as a natural response to strategically important shifts, from effective management of markets to innovation to knowledge and human resource management. Many approaches, methods and techniques of change management have emerged as a result of adapting HR structures, systems, strategies and practices to new requirements. The company increasingly needs an integrated approach to implement the envisaged changes effectively (Kim & Scott, 2019).

The successful implementation of organizational change demands a strategic and well-structured approach to enhance the effectiveness of change processes in a complex and ever-changing business environment.

To be successful, companies operating in an increasingly dynamic business environment with frequent states of uncertainty need to change more and more than companies operating in a less dynamic business environment with a higher degree of stability.

Regardless of the scope and speed of organizational change, companies must establish clear goals and standards for the change process while ensuring appropriate motivation for all stakeholders—those directly engaged in the process, those indirectly involved, and those impacted by the resulting changes. At the same time, it must ensure that all participants in the change process will have attitudes and behaviors that facilitate the effective making and implementation of change (Kotter, 2007).

The findings of our study reveal that, within the analyzed company, the factors influencing the effectiveness of organizational change implementation have a significant impact on the factors and practices driving the institutionalization of organizational change. This indicates that the effectiveness of the implementation process largely determines the success of institutionalizing organizational change, ultimately shaping the overall success of the organizational change process.

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Sustainability as a Determinant Factor in the Purchasing Decision

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Abstract

This article investigates the role of sustainability as a determinant factor in purchasing decisions, focusing on how Environmental, Social, and Governance (ESG)-related claims influence consumer behavior and brand performance. By employing a qualitative research methodology, the analysis synthesizes insights from academic literature and industry reports to explore the interplay between sustainability marketing practices and consumer decision-making. Key findings reveal that environmental concerns, green willingness to purchase, and long-term sustainability perceptions are critical drivers of green purchasing behavior. Additionally, the relationship between the number of ESG-related claims and product growth demonstrates the importance of multifaceted ESG strategies in enhancing consumer trust and loyalty. This research highlights the transformative potential of integrating sustainability into marketing strategies, providing actionable insights for businesses aiming to align with consumer demand for sustainable products.

Key words: sustainability, marketing, ESG, consumer behavior

J.E.L. classification: Q01, O44, M31

1. Introduction

The growing global emphasis on environmental conservation and social equity has positioned sustainability as a critical factor in modern business strategies and consumer behavior. Companies are increasingly pressured to adopt sustainable marketing practices, not only as a response to environmental and social concerns but also as a means to remain competitive in a rapidly evolving market. These practices involve integrating ecological, social, and ethical considerations into marketing strategies to ensure long-term societal well-being while addressing consumer demands.

Increasing apprehensions regarding global sustainability have prompted vigorous discussions and initiatives across all industries, with marketing significantly impacting both the issues and possible resolutions. Recent decades have experienced unparalleled economic expansion, innovation, and wealth; nevertheless, they have also resulted in detrimental consequences such as climate change, deforestation, pollution, biodiversity loss, and various other environmental issues. Conventional marketing paradigms have encouraged excessive resource use, whereas sustainability marketing emphasizes resource conservation and regenerative utilization.

Consumers play a pivotal role in shaping these sustainable practices through their purchasing decisions. By choosing sustainable brands, consumers send a strong message to businesses, encouraging them to align their strategies with sustainability goals. This shift in consumer behavior reflects a growing awareness of the environmental and social impacts of their consumption patterns and highlights the importance of informed decision-making. As more consumers prioritize sustainable products, companies are compelled to innovate, reduce environmental footprints, and promote ethical practices across their supply chains.

The interplay between sustainable marketing practices and consumer behavior forms a dynamic feedback loop. On the one hand, businesses adopting sustainable marketing can influence consumer preferences by demonstrating their commitment to environmental and social responsibility. On the other hand, consumer choices drive companies to further embed sustainability into their core strategies. Companies are embracing the ESG (Environmental, Social, and Governance) framework that has emerged as being a crucial component of their management strategy, enabling companies to measure and assess their impact on the planet, people, and their governance practices. This reciprocal relationship underscores the transformative potential of consumer behavior in fostering sustainability at both micro (individual) and macro (societal) levels.

Consumer advocacy is essential in fostering sustainable practices, which are vital for combating the negative effects of over-consumption. Advocacy organizations shape public policy, corporate strategy, and individual actions by increasing knowledge, promoting sustainable practices, and ensuring corporate accountability for environmental consequences. The emergence of digital platforms poses problems and opportunities for consumer advocacy, necessitating further research to identify optimal methods for digital advocacy in fostering sustainable behavior, prompting companies to act accordingly and adopt sustainable practices.

This research paper explores the role of sustainability as a determinant factor in purchasing decisions and its implications for sustainable marketing. By examining the motivations behind consumer choices and the responses of companies to these preferences, this study aims to highlight the importance of a synergistic approach where both businesses and consumers actively contribute to the global sustainability agenda.

2. Literature review

Sustainability has become an integral concept across various domains, including marketing (Kemper & Ballantine, 2019). Scholars such as Connelly (2007), Davidson (2014), and McDonagh & Prothero (2014) have debated its definitions within marketing, questioning whether the field can genuinely align with sustainability due to its reliance on continuous consumption, which conflicts with ecological limits (Jones et al., 2008; Peattie & Peattie, 2009; Sandberg & Polsa, 2015). Despite being criticized as the antithesis of sustainability (Jones et al., 2008; Lim, 2016), marketing holds the potential to foster sustainable lifestyles and promote eco-friendly products (Peattie & Peattie, 2009; Charter et al., 2002).

Ecological marketing, emerging in the 1970s, primarily addressed environmental hazards such as pollution and synthetic pesticides, with businesses like The Body Shop incorporating environmental values into their mission (Peattie, 2001; Van Dam & Apeldoorn, 1996). By the 1980s, green marketing had gained traction, responding to the demand from 'green consumers' and creating new markets (Peattie, 2001). However, green marketing faced criticism for overstating environmental claims, leading to consumer skepticism and exposing an attitude-behavior gap (Crane, 2000; Peattie, 2001). While ecological marketing emphasized ethics, green marketing was driven by consumer demand, yet both overestimated consumer willingness to pay premiums for eco-friendly products and producers' capacities to create them (Van Dam & Apeldoorn, 1996).

Sustainability marketing, evolving from ecological and green marketing, seeks to redefine marketing's role, advocating for radical changes in consumption and production patterns (Peattie, 2001). Introduced by Sheth and Parvatiyar (1995), sustainability marketing has been conceptualized in environmental and holistic frameworks (Fuller, 1999; Belz & Peattie, 2010), addressing socio-ecological issues at the beginning of the marketing process (Belz & Peattie, 2010). Fuller (1999) defines it as a process meeting customer needs, achieving organizational goals, and aligning with ecosystems. Scholars view sustainability marketing as a convergence of social, ethical, and green marketing, emphasizing long-term relationships and institutional transformation (Belz & Peattie, 2010; Gordon et al., 2011).

In contemporary contexts, green marketing plays a crucial role in minimizing environmental impact and fostering sustainable growth (Boztepe, 2012; Parhizgar & Vesal, 2016). Increasing consumer awareness has amplified scrutiny of production and promotional practices (Ferreira et al., 2023), necessitating investments in green marketing to meet consumer expectations and promote sustainable futures (Gomes et al., 2023). Green purchasing decisions (GPD) serve as a means for

consumers to demonstrate their commitment to sustainable development, highlighting the growing alignment between sustainability marketing and consumer priorities.

3. Research methodology

To investigate the role of sustainability as a determinant factor in purchasing decisions, this research employs a qualitative approach, emphasizing the analysis of existing literature and industry reports. The methodology is designed to provide a comprehensive understanding of the interplay between sustainability and consumer purchasing behavior, as well as the implications for sustainable marketing practices. The following steps outline the research process:

This study adopts a qualitative research design, which is suitable for exploring the complex relationship between sustainability and consumer behavior. The research aims to synthesize existing knowledge from diverse sources, offering an integrative perspective on the topic.

The research relies on secondary data sources, including: peer-reviewed journal articles were selected from international academic databases; these articles provide insights into sustainability concepts, consumer decision-making processes, and sustainable marketing practices. Reports from specialized organizations, such as McKinsey and Nielsen, were analyzed to understand market trends, consumer preferences, and corporate strategies related to sustainability. Articles and reports published within the past 10 years, focusing on sustainability, consumer behavior, and sustainable marketing practices, were included. Studies with a global or regional focus relevant to the topic were prioritized. A systematic review was conducted to extract and synthesize relevant themes from the selected literature and reports. Key topics, such as consumer motivations for choosing sustainable brands, the impact of sustainability on marketing strategies, and the role of corporate social responsibility (CSR), were identified and analyzed.

This methodological framework enables a thorough examination of sustainability as a determinant factor in purchasing decisions. By synthesizing insights from academic and industry sources, this research contributes to a deeper understanding of how sustainability influences consumer behavior and informs sustainable marketing practices.

4. Findings

Research indicates that environmental issues considerably influence customers' buying choices (Chen et al. 2022). Chen et al. (2022) conducted research on the influence of environmental concerns on customers' purchasing decisions on green items. This study identified five key elements that influence this behavior. The authors discovered that consumers with heightened environmental concerns are more inclined to engage in eco-friendly shopping behaviors (Chen et al. 2022). Research by Zhang and Dong (2020) indicates that individual characteristics, particularly environmental knowledge and awareness, significantly influence green purchasing behavior. Zhang and Dong (2020) assert that persons possessing more awareness of environmental issues are more inclined to make sustainable purchase decisions. A study conducted by Zhuang et al. (2021) further corroborates the notion that environmental knowledge is crucial in shaping consumer behavior. The authors discovered that as customers acquire environmental information, they increasingly focus on acquiring eco-friendly products, so reinforcing the notion that environmental concerns substantially influence consumers' purchasing choices (Zhuang et al. 2021). The studies present persuasive evidence that environmental concerns significantly impact consumer behavior; thus, companies that tackle these issues with eco-friendly products and sustainable practices are more likely to appeal to environmentally conscious consumers (Gomes et al. 2023).

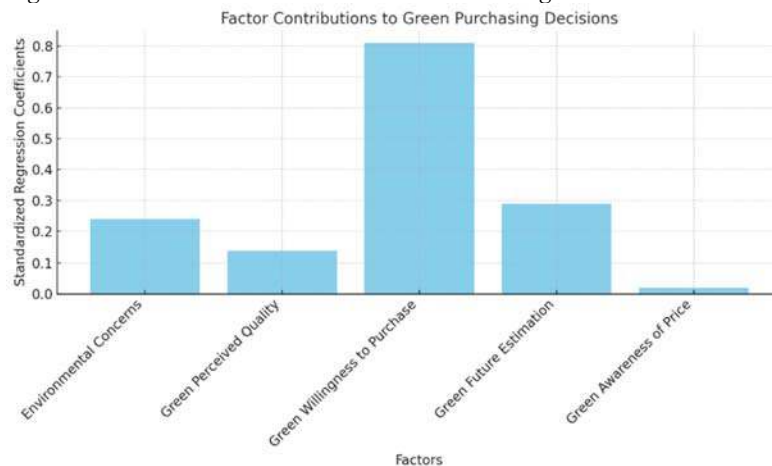
Green purchasing decisions are influenced by multiple factors, including environmental considerations, perceived green quality, and willingness to engage in green purchasing. Additional crucial factors encompass projections for a sustainable future in green marketing, consumer understanding regarding pricing, and perceived advantages of eco-friendly products. These aspects influence consumers' comprehensive green purchasing decisions, illustrating the intricate relationship among individual awareness, attitudes, and future expectations concerning sustainable products (Lopes et al. 2024). These elements influence consumer behavior concerning environmentally conscious shopping choices (Ogiemwonyi et al. 2023).

Various factors influence consumer attitudes and behaviors about eco-friendly items, hence affecting their green purchasing choices. A thorough review by Zhang and Dong (2020) identifies personal values, environmental awareness, social norms, and product features as the primary factors affecting customers' green purchasing behavior. Joshi and Rahman (2015) delineate the primary motives, facilitators, and obstacles affecting the decision to acquire green products, encompassing price, availability, and perceived quality. Therefore, comprehending these elements is essential for enterprises to proficiently promote their eco-friendly products to consumers and stimulate sustainable purchasing behavior. Eco-friendly items hold significant social value and can influence consumers' behavior towards more sustainable purchase choices. Parker et al. (2023) assert that emotional and social values are essential in the formation of GPD. Zhuang et al. (2021) found that customers' propensity to buy eco-friendly products is affected by both personal traits and the social environment, including the influence of others. Dikici et al. (2022) identified a significant association between consumers' values concerning green consumption and their green purchasing behavior. Consequently, highlighting the social and environmental advantages of green products can motivate customers to engage in more sustainable purchasing choices (Alam et al. 2024; Nekmahmud et al. 2022; Reddy et al. 2023).

In response to escalating environmental concerns, corporations are increasingly adopting green marketing techniques and encouraging eco-friendly purchase decisions to satisfy consumer demand for sustainable products and services. Peripheral regions, frequently neglected in sustainability discourse, provide a distinct chance to establish themselves as frontrunners in ecologically responsible activities via green marketing methods. This is a chance to enhance economic growth while safeguarding the environment for future generations.

The study we will be referring to investigates the determinants of green purchasing decisions (GPD) in Portugal, a peripheral European region. The key factors assessed include environmental concerns (EC), green perceived quality (GPQ), green willingness to purchase (GWP), green future estimation (GFE), green awareness of price (GAP), and green perceived benefits (GPB). We considered the scientific work developed by the research team consisting of Lopes et al. (2024) as having a significant contribution related to the research field. Next, we will highlight the most important data obtained from the study.

Figure no. 1 Factor contribution to Green Purchasing Decisions



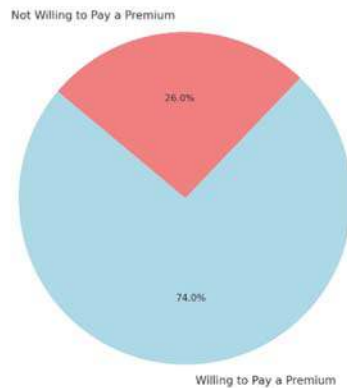
Source: Lopes et al.(2024)

The study reveals that environmental concerns have a moderate contribution to green purchasing decisions, indicating that individuals who are environmentally conscious are more likely to make green purchases. Companies targeting environmentally conscious consumers should emphasize the environmental benefits of their products (e.g., reduced carbon footprint, use of sustainable materials). Green Willingness to Purchase (GWP) is the largest contributing factor, according to the researchers, suggesting that an individual's intrinsic willingness and motivation to support green products are the most significant determinants of green purchasing behavior. Businesses can leverage this by

appealing to consumers' willingness through campaigns that emphasize personal impact and benefits of buying green products. Green Future Estimation has a notable contribution on green purchasing decision among consumers, indicating that individuals who believe in the future benefits of green purchasing or perceive long-term sustainability as essential are likely to engage in such behavior. Brands can highlight the forward-looking benefits of green purchases, such as conserving resources for future generations or mitigating environmental crises.

Green Awareness of Price holds the smallest impact, indicating that price sensitivity in the context of green purchasing may not significantly deter individuals. However, it is still a factor to consider for cost-conscious consumers. While price awareness matters, companies should focus more on other factors such as promoting environmental and future benefits to justify premium pricing for green products.

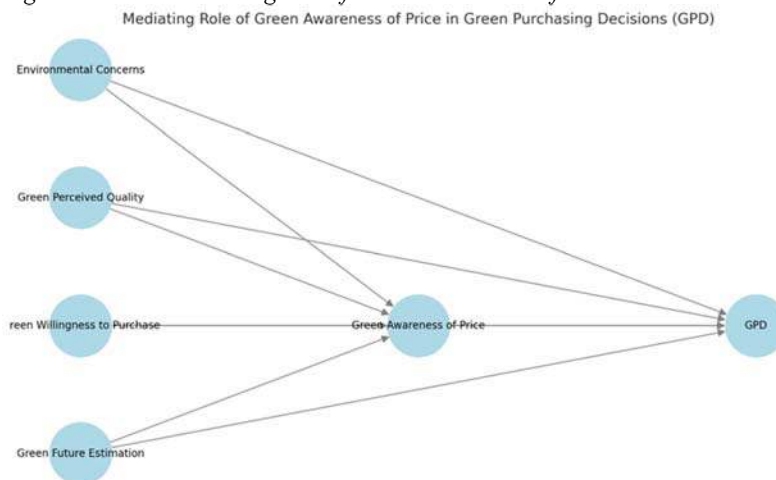
Figure no. 2 Consumer Willingness to Pay a Premium for Green Products



Source: Lopes et al.(2024)

As we can observe, a significant majority (74%) are willing to pay more, reflecting an optimistic outlook for green product adoption when value and benefits are well-communicated. Businesses should drive home the point that environmentally friendly products are of superior quality and offer several advantages to the environment. It is possible to further strengthen GPQ by establishing confidence through certifications and using manufacturing procedures that are transparent.

Figure no. 3 The mediating role of Green Awareness of Price in Green Purchasing Decisions (GPD)

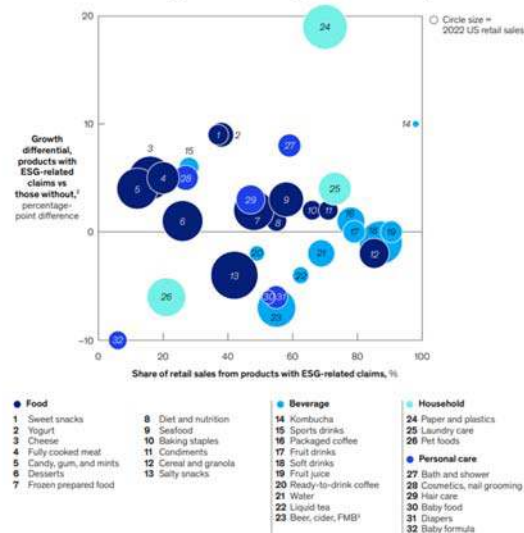


Source: Lopes et al.(2024)

This diagram illustrates the mediating role of "Green Awareness of Price" (GAP) in influencing Green Purchasing Decisions (GPD). The arrows indicate both direct and mediated relationships among key factors, emphasizing how GAP connects variables like "Environmental Concerns" and "Green Perceived Quality" to GPD. GAP does not directly predict GPD; however, it does play a significant role in mediating the relationship between the two by amplifying the impacts of other parameters such as GPB, GPQ, and EC among others. Despite the fact that it is theoretically significant, GPB had a limited direct influence in this context. This highlights the necessity of increasing the clarity of communication regarding the tangible benefits of environmentally friendly substances. One of the most important aspects of pricing awareness is that, despite the fact that GAP does not have any direct influence, its role as a mediator magnifies the influence of other variables. This demonstrates the importance of developing tactics that can justify premium pricing by educating consumers about the cost-benefit dynamics and the long-term savings attainable.

In the continuation of the research, we will analyze a joint report McKinsey and NielsenIQ(2023) which analyzes the correlation between companies that incorporate ESG-related claims to their products sales and sales growth. We focused on the key findings of growth differential between different product categories, customer loyalty and sales growth.

Figure no. 4 Growth differential vs prevalence of ESG-related claims by product category



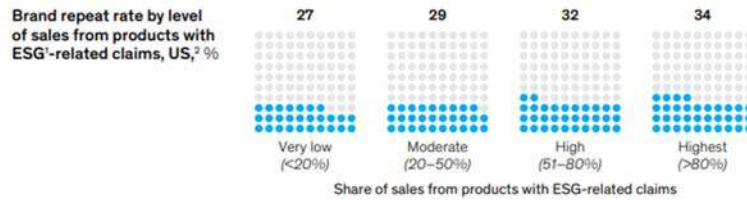
Source: McKinsey&NielsenIQ(2023)

The analysis presented in the graphs delineates the growth dynamics of products with Environmental, Social, and Governance (ESG)-related claims compared to those without such claims across various product categories. Notably, the Paper and Plastics category (Category 24) exhibits a remarkable growth differential of approximately 20% alongside a substantial retail sales share of around 90%, indicating a strong consumer resonance with ESG claims, particularly in sustainable packaging.

Similarly, Kombucha (Category 14) demonstrates a significant growth differential, attributed to its appeal among health-conscious and environmentally aware consumers. Other categories, including Bath and Shower (27), Cosmetics and Nail Grooming (28), and Laundry Care(25), reveal moderate growth differentials of about 5% but maintain high retail sales shares of 70-80%.This suggests a consistent consumer alignment with ESG claims, likely driven by the personal nature of these products and their ethical production associations. In contrast, categories such as Pet Foods (26), Hair Care (29), and Diapers (31) show low prevalence of ESG claims yet positive growth differentials, indicating potential for expansion in ESG-related messaging.

Figure no. 5 Growth of sales rate and loyalty measurement from products with ESG-related claims

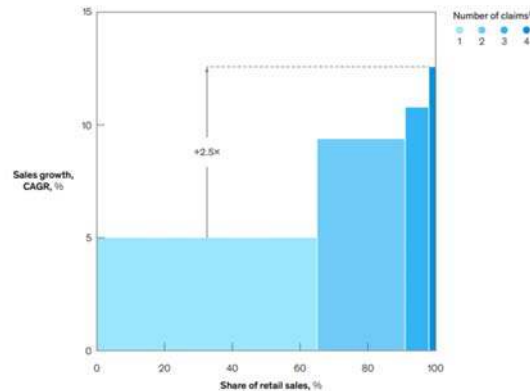
Brands with more sales from products making environmental, social, and governance-related claims enjoy greater loyalty.



Source: McKinsey&NielsenIQ(2023)

Furthermore, the correlation between the share of sales from ESG-related claims and brand repeat purchase rates underscores the positive impact of ESG commitment on customer loyalty. Brands categorized by their ESG engagement levels reveal that those with a Moderate (20-50%) to High (51-80%) share of ESG claims experience significant increases in repeat purchase rates, suggesting a threshold effect where consumer trust and loyalty are maximized when ESG claims dominate a brand's offerings.

Figure no. 6 Sales growth vs share of retail sales by number of ESG-related claims made by a product (US)



Source: McKinsey&NielsenIQ(2023)

Lastly, the relationship between the number of ESG-related claims and the compound annual growth rate (CAGR) in retail sales from 2018 to 2022 indicates that products with multiple ESG claims achieve significantly higher growth rates. Specifically, products with four ESG claims exhibit a CAGR approaching 15%, which is 2.5 times that of products with a single claim. This finding emphasizes the importance of multifaceted ESG strategies in enhancing product differentiation and driving sales growth, urging brands to broaden their ESG initiatives to encompass diverse dimensions of sustainability and ethical practices.

5. Conclusions

This research underscores the pivotal role of sustainability in shaping consumer purchasing decisions and guiding marketing strategies. Findings reveal that consumers are increasingly inclined to prioritize products with ESG-related claims, as evidenced by higher growth rates and brand loyalty for such offerings. Key drivers of green purchasing behavior include environmental concerns, intrinsic motivation, and long-term sustainability perceptions, while price sensitivity plays a lesser role. The study also highlights the significant impact of multiple ESG claims on product differentiation and sales growth, emphasizing the need for companies to adopt comprehensive and credible ESG practices.

From a practical perspective, this study suggests that businesses should integrate multifaceted ESG claims into their product portfolios and communicate their sustainability efforts effectively to build consumer trust. Furthermore, enhancing the transparency and authenticity of ESG-related

claims is essential to mitigate skepticism and foster long-term brand loyalty. By incorporating multiple, credible ESG claims into their marketing strategies, businesses can not only align with evolving consumer values but also achieve substantial growth in a competitive market. Marketers should prioritize educating consumers about the interconnected benefits of multiple ESG initiatives to build trust and encourage purchase behavior.

Future research could explore the role of digital advocacy and technological innovations in promoting sustainable consumer behavior and evaluate the long-term business impact of sustainability-focused marketing strategies. By adopting a synergistic approach that aligns business practices with consumer expectations, companies can contribute to the broader global sustainability agenda while achieving competitive growth.

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Integrating Artificial Intelligence into Companies' Marketing Strategies

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Abstract

The rapid advancements in artificial intelligence (AI) have revolutionized industries globally, transforming how companies operate and engage with their audiences. This article explores the integration of AI into marketing strategies, leveraging the latest statistics and insights. With AI poised to contribute trillions to the global economy and redefine job roles, businesses must strategically adopt AI to remain competitive. This discussion also includes personalized interpretations of data and actionable recommendations for companies navigating this paradigm shift.

Key words: artificial intelligence, marketing, business

J.E.L. classification: M31, Q55

1. Introduction

Artificial intelligence has transcended its role as a futuristic concept to become a cornerstone of modern business operations. From generative AI's ability to enhance customer interactions to its transformative role in automating repetitive tasks, AI is reshaping the marketing landscape. In 2023 alone, AI tools like ChatGPT reached millions of users within weeks, signaling their widespread acceptance and potential. For decades, academics have been fascinated by artificial intelligence's potential and risks. The 1956 Dartmouth Summer Research Project on Artificial Intelligence is credited with sparking academic interest in the topic (Haenlein & Kaplan, 2019 in Praveen et al., 2021), AI currently being considered one of the world's most promising new technologies, encompassing programs, algorithms, systems, and robots that simulate intelligent human behavior (Huang & Rust, 2018; Shankar, 2018). Machine learning, natural language processing, and neural networks are among the technologies that enable computers to sense, comprehend, act, and learn through human-machine interaction (HMI) (Davenport et al., 2020).

According to Haleem et al., (2022), by incorporating AI into their marketing strategy, companies can make greater use of the data at their disposal and connect with potential clients at more convenient times with eye-catching ads. Digital marketing uses AI to advertise on social media and digital platforms like Facebook and Instagram, giving customers a distinctly positive experience. These systems carefully evaluate consumers' information before presenting them with offers that suit their needs. AI helps marketers predict and identify trends as well (Forrest&Hoanca, 2015; Dumitriu & Popescu, 2020). It keeps the business from overspending on digital advertising and guarantees that the funds are used wisely.

Artificial Intelligence (AI) will eventually be a crucial component of all businesses worldwide. The AI landscape has seen significant changes, which are reflected in the latest trends in AI-driven automation. The enterprise's reshaped concepts, interests, and investments in the sphere of AI adoption are clear indicators of this (Verma et al, 2021; Dimitrieska et al., 2018; Arsenijevic et al., 2019 in Haleem et al., 2022). The ability to recognize faces and things thanks to this technology's sophistication has significant ramifications for a range of business applications. Individuals can be

identified for security purposes using facial recognition, while photos can be identified and analyzed using object detection. By treating human photos similarly to cookies, AI enables more individualized services according to client preferences. Some companies are experimenting with facial recognition to determine the moods of their clients and then propose products that suit them (Yang et al, 2021; Jain&Aggarwal, 2020). In digital marketing, lead conversion and user retention are AI's main concerns. Using interactive web design, intelligent email marketing, AI chatbots, and other digital marketing services, it can steer a user in the route that best suits the objectives of the company.

AI has made it easier to understand the customer journey process and create client profiles. In any point of the marketing funnel and across all channels, it enables brands to swiftly and simply offer meaningful, personalized content for the different client profiles. AI-powered digital marketing tools can identify the content that will most likely drive users back to a website based on past data. AI determines which consumers are most likely to cancel their subscriptions to a particular service and examines the characteristics that unsubscribers share in common. Digital marketing apps that use artificial intelligence (AI) can sort through billions of online data points and pinpoint just what information is necessary for business. The optimum time to post, the price that will generate the most conversions, the subject line that will attract the most attention, and other details will be covered (Haleem et al., 2022). Astute marketers remain up to date on every trend. It streamlines tasks and promotes greater innovation and creative problem-solving. Additionally, it enhances the value for the clients.

The expansion of AI and its potential for the marketing sector are substantial (Kumar, 2021). In this context, the incorporation of AI into our daily existence is no longer a question of "if," but rather "when." Although AI is advancing the productivity frontier for economies and enterprises in numerous sectors, marketing is unequivocally one domain poised to benefit the most from AI (Davenport et al., 2020; Huang & Rust, 2021); thus, through extensive research, scholars and practitioners can reveal new findings that can help companies benefit from AI usage.

2. Literature review

Artificial Intelligence is a computational technique that instructs computers to understand and replicate human speech and behavior. According to the presented data, AI has developed a novel intelligent computer that thinks, responds, and executes tasks similarly to humans. Artificial intelligence is capable of executing complex and specialized tasks, including robotics, speech and image recognition, natural language processing, and problem-solving. Artificial Intelligence comprises several technologies that can do jobs requiring human intellect. When utilized in conventional commercial operations, these technologies can acquire knowledge, execute actions, and operate with human-like intelligence. It emulates human intelligence in machines, save time and resources in commercial transactions (Toorajipour et al., 2021; Chintalapati& Pandey, 2022; Marinchak et al, 2018, Soni, 2020 in Haleem et al., 2022).

The early usage of AI in marketing commenced in the 1940s, driven by Alan Turing's code-breaking apparatus and Isaac Asimov's laws of robotics. The historical progression of AI has undergone various phases, each characterized by distinct advancements and obstacles (Haenlein & Kaplan, 2019). Until the early 2000s, the concept of AI in marketing was nascent, as corporations commenced investigations into data mining techniques to enhance their comprehension of customer behavior and preferences (Aflalo, 2020). During the 2010s, the proliferation of Big Data enabled AI-driven prediction algorithms to anticipate future behaviors and trends by examining user behavior, purchase history, and interactions (Simpson, 2020). The emergence of chatbots and virtual assistants like Siri and Alexa in the 2010s marked a pivotal moment in AI-driven marketing (Kaplan & Haenlein, 2019; Verma et al., 2021). These AI-driven solutions facilitated instant, tailored contact with consumers. In the late 2010s, advancements in machine learning and deep learning enabled increasingly sophisticated and autonomous AI applications in marketing. The processing and analysis of unstructured data, including text and images, facilitated enhanced content and visual recognition (Qin & Jiang, 2019). As we progress through the 2020s, the application of AI in marketing has evolved from a mere technology tool to a pivotal driver of innovative strategies.

Companies are already utilizing an increasing number of AI-driven marketing solutions designed for specific purposes.

The key objectives of early applications were customer segmentation, targeting, and positioning. Email marketing platforms have commenced utilizing AI to enhance dispatch timings and email content, resulting in elevated open rates and engagement levels. The emergence of search engines like Google has become AI essential for developing algorithms for search engine optimization (SEO) and pay-per-click (PPC) advertising (Danao & Main, 2022). Marketers commenced the optimization of keywords, bids, and advertisements, hence enhancing visibility and click-through rates (Schwartz, 2022). This period marked the advent of programmatic advertising, facilitating automated, real-time auction-based ad purchasing while enhancing user targeting precision and scalability (Das, 2023). In the late 2000s, the emergence of social media platforms like Facebook and Twitter created new opportunities for artificial intelligence. Marketers have gradually started to employ AI-driven technologies for brand monitoring, sentiment analysis, and social media management and analytics (Kaput, 2022). Companies utilized these strategies to get understanding of customer feelings and trends in order to create more tailored and flexible marketing campaigns.

Artificial intelligence (AI), defined by robust algorithms and machine learning proficiency, has transformed marketing (Noble & Mende, 2023). Haleem et al. (2022) characterize AI as a technology enabling computers to replicate and understand human interaction and behavior, while Haenlein and Kaplan (2019) describe it as a 'system' capable of analyzing external data, deriving insights, and applying acquired knowledge to accomplish specific goals and tasks through adaptable methods. Mustak et al. (2021) regard AI as an overarching notion encompassing several actions and ideas, based on the premise that various computer systems, utilizing software and algorithms, may assist or perform jobs that previously required human cognitive abilities.

Haleem et al.(2022) states that artificial intelligence focuses on developing intelligent computers capable of human-like thought and action and can have remarkable prospects for various businesses, nowadays almost every industry being apprehensive or captivated by the emergence of AI. Artificial intelligence develops sophisticated computers and systems capable of human-like cognition and response. This technology has been termed the "next phase" of the industrial revolution. Moreover, AI may assist in forecasting impending issues and has the capacity to generate novel technologies, industries, and ecosystems. AI emulates human cognitive processes using technology. This may encompass learning, reasoning, and, crucially, the capacity for self-correction (Marinchak et al., 2018;Kaplan, 2021; Elhajjar et al., 2021). Artificial intelligence can analyze, understand, and make decisions. This pertains to existing user data and is utilized for market projections and forecasting user behavior. Commonly referred to as data forecasting, it is employed by organizations globally to optimize their sales and marketing tactics to enhance revenue. Contemporary AI applications in marketing predominantly utilize machine learning, encompassing tasks such as personalizing product recommendations, identifying optimal promotional channels, calculating churn rates or client lifetime value, and constructing enhanced consumer segments (Tiwari&Sistrava, 2021;Schiessl et al., 2021).

3. Research methodology

This study employs a mixed-methods approach to examine the integration of artificial intelligence (AI) into marketing strategies and its impact on business operations, customer engagement, and revenue generation. Secondary data was gathered from reputable sources such as Statista, Gartner, McKinsey & Company, and academic journals. These data sources provided insights into AI adoption rates, market size, and sector-specific applications. Case studies, such as those of companies like Amazon, Adidas, Netflix, and Accenture, were referenced to illustrate real-world applications of AI in marketing. A review of academic literature was conducted to trace the historical evolution of AI in marketing, from early applications like data mining to contemporary uses such as generative AI and predictive analytics. Specific use cases, including lead identification, marketing optimization, and personalized outreach, were examined to understand the perceived impact of AI on marketing functions.

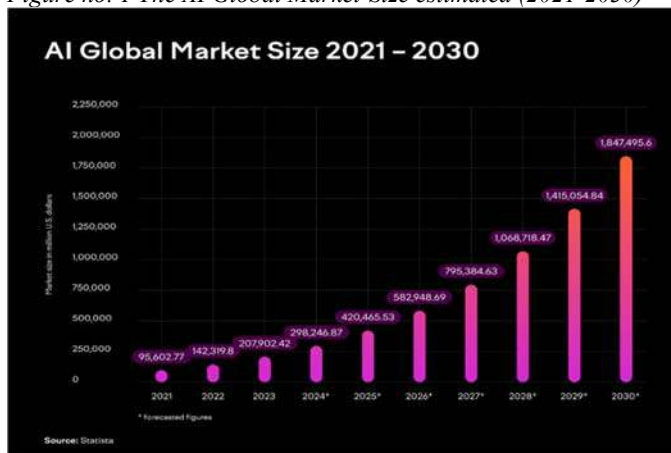
Statistical data was used to evaluate economic trends and forecast the future role of AI in various sectors, as well as the adoption and impact of AI usage by companies.

4. Findings

The graph illustrates the growth trajectory of the global artificial intelligence (AI) market size from 2021 to 2030, as reported by Statista. In 2021, the market size was approximately \$95.6 billion, and this figure rose significantly to around \$207.9 billion by 2023. The market is projected to grow at an exponential rate, reaching nearly \$1.85 trillion by 2030. This upward trend demonstrates a compounded annual growth rate (CAGR) driven by advancements in AI technologies, increased integration across industries, and growing investments in AI-based solutions. It is estimated that a substantial growth phase will occur between 2025 and 2027, with the market size predicted to nearly double from \$420.5 billion to \$795.4 billion within this period. By 2028, the market is forecasted to surpass the \$1 trillion mark, indicating a paradigm shift in global AI adoption.

This data underscores the transformative impact of AI on global economies, emphasizing its centrality to innovation and technological progress in the coming decade.

Figure no. 1 The AI Global Market-Size estimated (2021-2030)

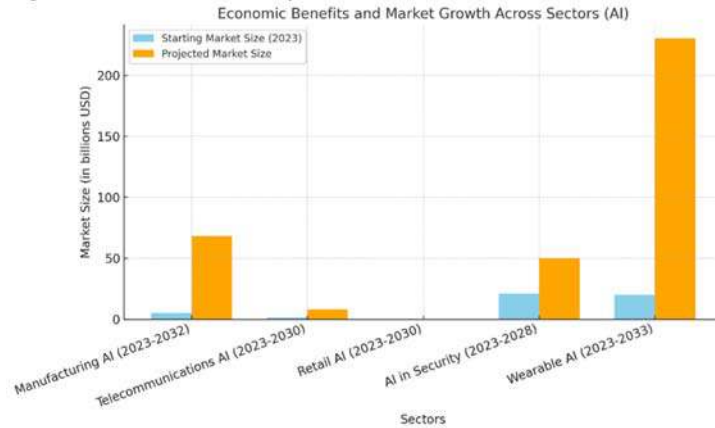


Source: Semrush (2024), based on data obtained from Statista (2023)

Organizations report that 34% of business-related tasks are performed by machines (World Economic Forum, 2023). This figure highlights the significant penetration of AI and automation in business operations, driven by advancements in machine learning and robotic process automation. While this percentage reflects current adoption, it also suggests room for growth, especially as businesses seek to increase efficiency and reduce operational costs. By October 2023, 55% of organizations were piloting or implementing generative AI solutions (Gartner, 2023). This indicates a growing trend toward leveraging generative AI technologies, such as ChatGPT, for innovative applications, from content creation to customer service. 50% of strategic planning and execution activities could potentially be automated (Gartner, 2023), but only 15% of such activities are currently automated. This gap underscores the untapped potential for AI in decision-making and planning processes, which could enhance both speed and accuracy in strategic initiatives.

Businesses adopting AI can expect a 6% to 10% revenue increase (Statista, 2023). This growth reflects AI's ability to optimize operations, improve customer experiences, and generate data-driven insights. The global market size for AI is rapidly expanding across sectors: manufacturing AI is projected to grow from \$5 billion in 2023 to \$68 billion by 2032 (Precedence Research, 2023). AI in telecommunications is expected to grow at a CAGR of 28.2% from 2023 to 2030 (Grand View Research, 2023). The retail AI market is forecast to expand at a CAGR of 30% over the same period (Global Market Insights, 2023). AI in security is valued at \$21 billion in 2023, with forecasts suggesting a growth to over \$50 billion by 2028 (Mordor Intelligence, 2023). Similarly, the wearable AI market, valued at \$20 billion in 2023, is projected to reach \$230 billion by 2033 (Fact MR, 2023). These projections indicate not only economic growth but also AI's increasing integration into consumer products and services.

Figure no. 2 Economic benefits and Market Growth across Sectors due to AI usage



Source: processed by the authors based on data obtained from <https://www.semrush.com/>

McKinsey & Company conducted an analysis of over 400 AI use cases across 19 industries and nine business functions, concluding that the most substantial potential value of AI is predominantly linked to marketing and sales sectors (Chui et al., 2018). In 2022, a thorough global survey by Salesforce Research indicated a substantial rise in AI usage among marketing professionals compared to the prior year. The poll revealed that 87% of marketing professionals utilized AI to integrate online and offline encounters, a significant rise from 71% in 2021 and the same percent (87%) employed AI to proficiently address consumer identities, reflecting an increase from 82% in 2021 (Kumar et al., 2024). Furthermore, the survey indicated that 88% of marketing professionals utilized AI to automate diverse operations, including reporting, above the 83% documented in 2021 (Salesforce, 2023).

AI could increase labor productivity growth by 1.5 percentage points over the next decade (Statista, 2023). This statistic aligns with AI's potential to automate repetitive tasks, enabling workers to focus on higher-value activities and fostering innovation. According to Gartner (2023), 79% of corporate strategists emphasize that AI and similar technologies will be critical to business success. This reflects a strategic pivot among organizations toward digital transformation and reliance on AI for competitive advantage. The savings reported by organizations, such as 46% of American companies saving between \$25,000 and \$70,000 using ChatGPT (Statista, 2023), demonstrate the immediate financial impact of AI in reducing operational costs.

Figure no. 3 The Impact of using ChatGPT in Labour productivity among U.S. Companies

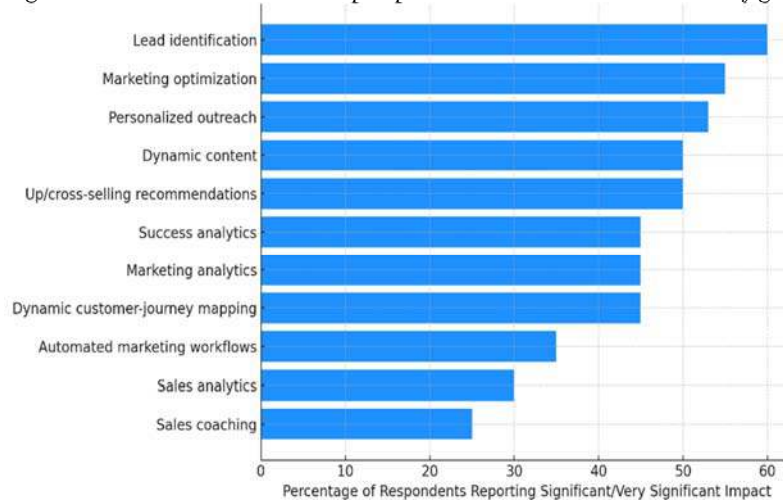


Source: Semrush (2024), based on data obtained from Statista (2023)

A research conducted by McKinsey&Company (2023) also revealed a strategic optimism among commercial leaders regarding the transformative potential of generative AI in business contexts. The key findings are as follows: lead identification (60%) is viewed as the most impactful use case, underscoring AI's ability to analyze real-time customer trends and improve sales targeting. Marketing optimization (55%) and personalized outreach (53%) also rank highly, reflecting the value of AI in refining customer engagement strategies through tools like A/B testing, SEO, and chatbots. Tasks such as dynamic content creation (50%), cross-selling recommendations (50%), and analytics-based activities like churn modeling (45%) highlight AI's capacity to optimize and automate customer-facing and backend operations. Dynamic customer-journey mapping (45%) indicates the importance of AI in identifying critical customer touchpoints to enhance user experience. Sales analytics (30%) and sales coaching (25%) are considered less impactful. This could be due to limited adoption or perceived challenges in integrating AI into highly nuanced or interpersonal tasks like negotiation and personalized training.

These statistics suggest that AI is expected to have the greatest impact in tasks requiring real-time data analysis and personalization, while applications requiring domain-specific expertise or human interaction may lag. The data also reflects that AI's adoption is driven by its ability to deliver measurable ROI through enhanced efficiency, customer engagement, and data-driven insights.

Figure no. 4 Commercial leaders' perspective on use cases and the role of gen AI in marketing and sales



Source: processed by authors based on data obtained from McKinsey&Company (2023)

These findings illustrate the increasing dependence on AI in the marketing sector to improve client experiences, optimize processes, and enhance productivity. Today, many international companies are using AI in creative ways to provide the most favorable purchasing experiences for their customers. For example, AI is revolutionizing customer service across all sectors. Amazon Prime Air's AI-driven delivery technology exemplifies a significant advancement in artificial intelligence that will transform our delivery service experience. Prime Air intends to deliver packages within 30 minutes after order placement. The AI system driving Prime Air continuously learns and enhances its capabilities, allowing drones to navigate varied environments more effectively, adjust to fluctuating weather conditions, and identify the most efficient flying routes. This ongoing education guarantees that Prime Air advances and becomes increasingly reliable, delivering parcels with unmatched speed and accuracy. The AI-driven Prime Air delivery program has the potential to revolutionize consumer purchasing habits and company models by providing advantages such as rapidity and cost efficiency.

Secondly, the conventional online retail business model adheres to the shopping-then-shipping paradigm, wherein users submit orders prior to the online retailer dispatching the products (Davenport et al., 2020). Nonetheless, Stitch Fix, a multi-brand online retailer focused on fashion, and Amazon, utilizing its anticipatory shipping approach, have inverted the order. By utilizing AI's capacity to analyze vast datasets, online businesses may provide highly accurate forecasts regarding

consumer preferences. This feature enables shops to transition effortlessly to a shipping-then-shopping business model (Grandinetti, 2020). Stitch Fix utilizes an internal AI system that integrates customer style, size, price preferences, and qualitative data (such as images), while also incorporating insights from other customers with analogous preferences to assemble a selection of five items for each Fix shipment. Customers may retain desired things and return those they do not wish to keep. This transition will allow customers to entrust their purchasing decisions to the AI program, which predominantly bases its choices on the customer's prior purchases. As a result, in the era of AI, marketing strategies and business models are transitioning from a "reactive" approach to a more "predictive" one. While it is premature to reach definitive conclusions, a significant insight is that AI serves as a potent instrument for customizing content, services, and suggestions to individual tastes, hence improving customer happiness and fostering enduring loyalty. The primary functions of marketing encompass comprehending client requirements, aligning them with the company's products, and persuading individuals to make a purchase. Historically, these operations are distributed across many functions (namely, marketing, sales, and service), predominantly functioning autonomously. AI may enhance a company's skills by focusing on marketing, service, and sales, resulting in outstanding conversion rates.

Generative AI serves as a tool for content and idea generation for over 50% of marketers in the industry (Rodrigue, 2023). Adidas and Netflix illustrate the extensive applications of AI in the business sector. Both organizations employ AI to scrutinize extensive customer data to discern patterns, trends, and insights that can guide marketing plans and campaigns (Mathur, 2023; Prentice et al., 2020). Accenture use AI to enhance its marketing budget by optimizing data collecting, hence decreasing the data flow process duration by 80% (Mishra et al., 2022). This has enabled the corporation to reduce the insight lag from 5 months to 5 weeks, allowing Accenture to achieve an additional \$300 million in sales without augmenting media expenditures (Accenture, 2024). Furthermore, AI demonstrates compelling applications in analyzing client behavior and habits post-purchase. The progression of AI technologies and capabilities has significantly transformed the manner in which marketers engage with clients, comprehend their needs, and deliver value (Kumar et al., 2019; Kumar, 2021). It functions as a conduit between technology and marketing to foster innovation, enhance consumer experiences, and attain exceptional marketing outcomes (Huang & Rust, 2021). The swift advancement of AI raises ethical issues, including data privacy, algorithmic prejudice, and erroneous predictions; yet, robust norms and legislation help mitigate these obstacles (Elliott & Soifer, 2022; Manyika et al., 2019). Incorporating AI into marketing strategies signifies a shift towards data-driven and consumer-focused approaches, promising a future where marketing is increasingly responsive, flexible, and efficient.

5. Conclusions

The incorporation of artificial intelligence into marketing tactics is not only unavoidable but also likely to bring about significant business changes. A number of important insights are highlighted by the findings:

It is anticipated that the implementation of artificial intelligence would spur significant economic expansion, with estimations of the size of the worldwide market indicating an increase from \$95.6 billion in 2021 to \$1.85 trillion by 2030. Several industries, including retail, telecommunications, and manufacturing, are expected to have tremendous growth in the next years, with some of these industries forecast to experience compound annual growth rates.

By automating operations that are repetitive and allowing people to focus on activities that are of higher value, artificial intelligence (AI) increases labor productivity. The anticipated increase in productivity growth over the next ten years is predicted to be 1.5 percentage points higher than it was in the previous decade.

The consumer engagement landscape is being reshaped by tools powered by artificial intelligence (AI), such as chatbots, tailored content recommendations, and predictive analytics. Applications such as lead identification (defined by sixty percent) and marketing optimization (defined by fifty-five percent) are acknowledged as the most profound use cases.

Companies who use artificial intelligence report quantifiable benefits, such as cost reductions and increased return on investment (ROI) in marketing through the utilization of real-time data analysis.

Although it cannot be denied that the incorporation of artificial intelligence has many benefits, it also presents a number of obstacles, including data privacy concerns, ethical constraints, and algorithmic prejudice, despite the fact that it has many advantages. In order to provide solutions to these difficulties, stringent laws and industry standards will be required. Businesses need to prioritize innovation while also guaranteeing ethical procedures and maintaining the trust of their customers as artificial intelligence technology continues to advance.

When it comes to marketing, artificial intelligence represents a paradigm change since it offers prospects for personalization, efficiency, and growth that are unmatched by any other technology. For the purpose of providing a thorough knowledge of the revolutionary potential of artificial intelligence, studies in the future should investigate the long-term ramifications of AI adoption, particularly in new markets and industries that are underrepresented.

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Key Factors in Talent Retention: An Integrated Approach Based on Bibliometric Analysis

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Abstract

Managing talent retention is a strategic priority for organizations, given the accelerated dynamics of the labor market and the effects of technological transformations. This study provides a systematic analysis of 108 articles from the literature, using bibliometric techniques with VOSviewer software, to highlight the links between talent retention and four key strategies: organizational culture, work-life balance, employee rewards and the role of digitalization.

A healthy organizational culture and transformational leadership are key to employee retention. Initiatives that support work-life balance reduce intentions to leave the organization. Recognition and professional development programs contribute significantly to increasing employee engagement. Implementing advanced technologies such as artificial intelligence offers new opportunities for talent retention, but requires new managerial skills.

The study provides an analysis on the topic of talent retention over the last 10 years and the highlights the importance of tailoring strategies to the needs of employees and the organizational context.

Key words: talent retention, organizational culture, work-life balance, reward, bibliometric analysis

J.E.L. classification: M12, M52, M54, J24, J53

1. Introduction

Talent retention is a major challenge in contemporary management, especially in a globalized and dynamic economic environment marked by accelerated technological change and a highly competitive labour market. Modern organizations face significant difficulties in attracting and retaining the most valuable employees, with direct implications for organizational performance, innovation and long-term sustainability. Talent is no longer seen as just an organizational resource, but as a key differentiator, influencing both competitive positioning in the marketplace and the organization's ability to meet the challenges of the future.

In a previous article we looked at what are the most common practices when it comes to talent retention and it turned out that strategies around organizational culture and work-life balance were in the researchers' focus, while rewarding employees and the role of technology were not prevalent (Săcuiu & Micu, 2024).

In this context, we have shortened the time period of study in order to find new directions and possible links, and the focus of this paper will be on those terms that did not stand out in the previous article.

Through a systematic literature review, based on 108 relevant articles from the Scopus database and using bibliometric techniques through the VOSviewer software, the interconnections between these strategies will be identified, thus providing an overview of organizational decisions to retain talent and reduce the risk of leaving the job. As the business environment evolves, the integration of these strategies becomes indispensable to ensure not only organizational stability but also long-term competitiveness.

2. Literature review

The literature highlights four major directions of action that influence talent retention: organizational culture, work-life balance, employee development and reward, and the role of digitalization (Mathis, et al., 2017).

Organizational culture, considered at the core of any successful organization, plays a crucial role in employee retention. Shared values, an inclusive environment and transformational leadership are just some of the components that shape employee behaviors and create a sense of belonging. A healthy organizational environment not only encourages innovation and adaptability, but also ensures better retention by creating authentic relationships between employees and the organization.

Work-life balance is another critical dimension of talent retention. In a global context where job stress and burnout have become acute problems, organizations that support flexible working hours, provide mental health support and implement hybrid work policies are more likely to retain a motivated and loyal workforce (Davis, 2021). Recent studies suggest that initiatives that respond to employees' personal needs, directly contribute to a reduction in the intention to leave, thus increasing workforce stability.

Developing and rewarding employees is closely linked to perceptions of fairness and opportunity within the organization. Ongoing training programs, mentoring and recognition of merit are just some of the strategies used to strengthen employee loyalty and motivate employees to reach their full potential (John, et al., 2020). In this sense, reward is not only about the financial aspects, but also includes symbolic recognition, personalized benefits and promotion opportunities that add value to the professional experience.

Digitalization as a cross-cutting phenomenon is redefining all aspects of talent retention. The introduction of advanced technologies, such as artificial intelligence and data analytics, enables organizations to personalize employee experiences, streamline talent identification processes and monitor talent satisfaction in real time (Autor, et al., 2021). However, digitization also brings new challenges, in particular in terms of digital skills and the need for continuous adaptation to technological change.

3. Research methodology

This study uses a bibliometric methodology to explore relationships and trends in the literature on talent retention and associated strategies. Bibliometric analysis is a robust approach to identify emerging patterns, key concepts and their relationships. This method was chosen because of its ability to provide a clear and detailed insight into the interconnections between scholarly articles by multiple authors that have talent management in organizations as a common theme.

Thus, the use of the VOSviewer software allowed us to structure the complex domain of talent retention into four major clusters that reflect the link to the key strategies of this study.

For such an analysis we used the Scopus database, the advantage being its extensive coverage and relevance to the social sciences and economics. The key terms underlying the search were: talent retention AND organizational culture OR work-life balance OR employee recognition OR digitalization, combined using both the Boolean AND, and OR operators. To ensure the relevance and timeliness of the results, the following selection criteria were applied:

- Publication period - scientific sources published between 2013 and 2023;
- Language - only documents written in English;
- Type of documents - articles, books and books' chapters;
- Publication stage - only documents in final stage.

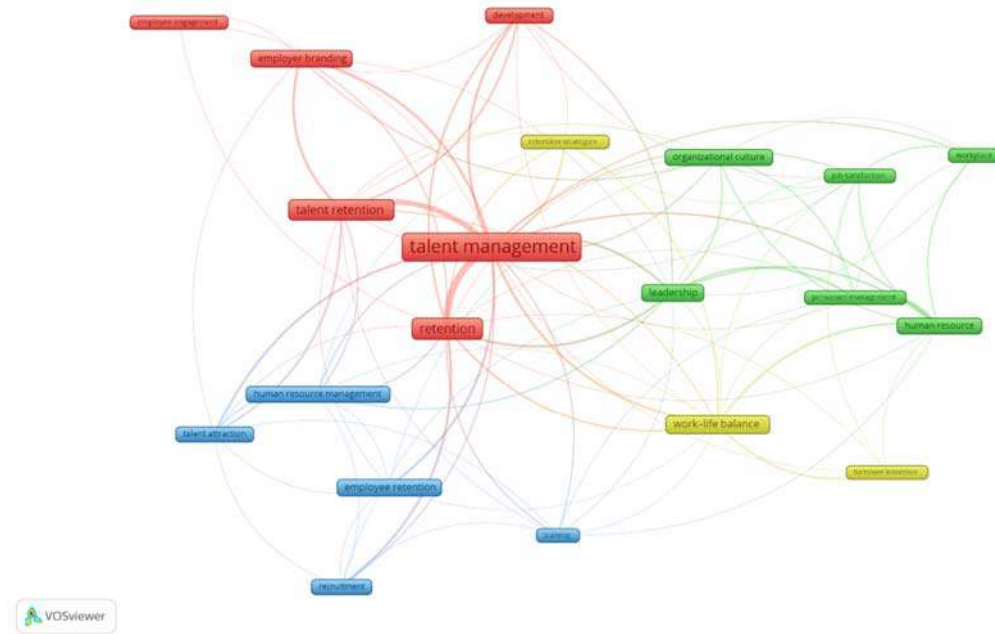
Following the search and selection process, 108 relevant articles were identified for our analysis.

After literature selection, the VOSviewer software was used for bibliometric analysis, as it is a tool recognized in the academic community for its ability to visualize complex networks and identify significant clusters in the literature. The analysis included:

- Co-occurrence networks of all keywords: to identify dominant themes in research;
- Keyword processing: to avoid duplication of terms due to abbreviations;

- Citation analysis: to highlight influential articles and authors in the field;
- Thematic clustering: to group terms according to their interconnections and identify the four key strategies.

Figure no. 1. Network vizualization of co-occurrence based on all keywords



Source: VOSviewer

3.1. Cluster 1 - Talent retention and employee engagement (Figure no. 2)

Professional development plays a critical role and is perceived by employees as an investment in their long-term potential. Mentoring relationships and development programs contribute significantly to employee retention by giving employees a clear vision of their career trajectory within the organization.

The concept of employee engagement is often associated with motivation, job satisfaction and commitment to organizational goals. According to the literature, organizations that promote a sense of belonging and recognition are more likely to retain valuable talent (Schein, 2010).

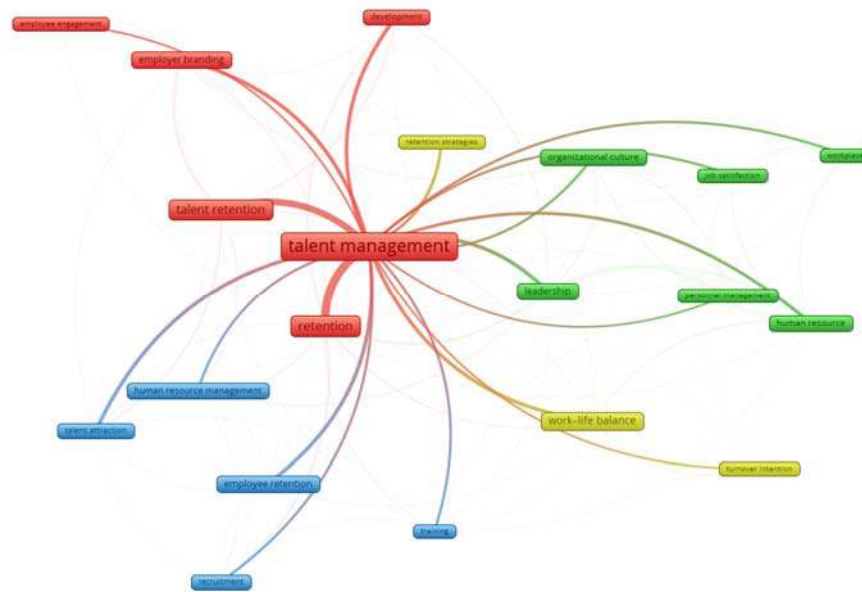
Employer branding is also a strategy to position your organization as a top employer. A strong employer brand creates a competitive advantage not only in attracting talent but also in retaining employees. Recent studies underline that organizations that align their internal values with their public promises contribute to increased employee trust and loyalty (Cameron & Quinn, 2011).

Effective talent management and talent retention strategies require a holistic approach. They must include initiatives that address the diverse needs of employees, such as training opportunities, recognition and rewards. Retention is not just a reactive process it is a proactive measure that involves constantly monitoring employee satisfaction and adapting to changes in the organizational environment.

Organizing and implementing effective policies that combine professional development with active employee engagement and consistent employer branding are essential components for talent retention (Reis, et al., 2021).

Thus, it can be seen from Figure no. 2 that the main key term that has close links with all the other terms is talent management. The actions and decisions taken regarding talent management in the firm will influence everything from employees' well-being to their intention to leave the company.

Figure no. 2. Cluster 1 (red)



Source: VOSviewer

3.2. Cluster 2 - Organizational culture and the role of leadership (Figure no. 3)

Organizational culture is one of the key pillars for talent retention, influencing both employee satisfaction and engagement. Edgar Schein argues that a healthy organizational culture supports adaptation, innovation and a sense of belonging (Schein, 2010).

Clear organizational values and transformational leadership are critical elements to attract and retain ones talent. Recent studies highlight that inclusive work environments that promote diversity and equality increase the likelihood of employee retention (Cameron & Quinn, 2011).

Creating a strong culture based on clear values and a positive workplace environment is crucial to improving job satisfaction.

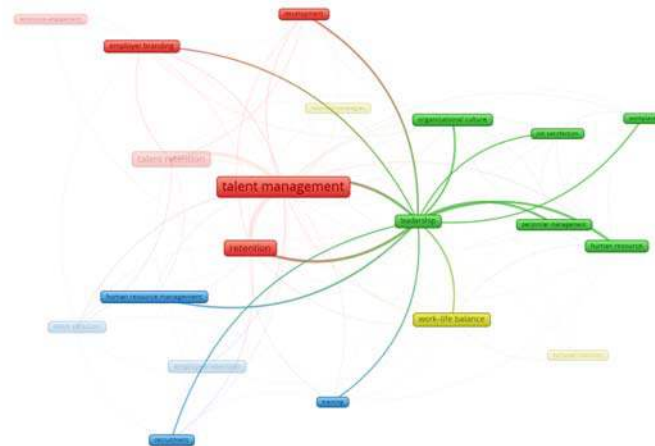
Another fundamental element is leadership. The leadership of the organization plays a decisive role in shaping organizational culture and talent management. Inspirational and transformational leaders are able to create an attractive vision and motivate employees to reach their full potential. Studies show that employees who perceive quality leadership are more engaged and loyal to the organization (Collings, et al., 2019).

Human resource management (HRM) and personnel management (PM) are complementary areas that contribute to talent retention. They include policies and practices that support the recruitment, integration and development of employees, as well as approaches focused on increasing their job satisfaction (Sourabh, 2021).

A supportive work environment combined with a well-defined organizational culture has a positive impact on employee performance and retention. In addition, job satisfaction is influenced by factors such as leadership style, organizational support and perceptions of fairness. Satisfied employees are less likely to leave the organization, which contributes to workforce stability and reduces the costs associated with turnover.

The interconnection between organizational culture, leadership and employee satisfaction underlines the need for an integrated approach to talent management. Leaders play a key role in creating an environment that promotes engagement and supports talent retention.

Figure no. 3. Cluster 2 (green)



Source: VOSviewer

3.3. Cluster 3 – Professional Development and Recruitment for Employee Retention (Figure no. 4)

Professional development is a central component in the employee retention strategy. Organizations that invest in continuous learning and in creating opportunities for professional growth are more likely to retain more motivated and loyal employees. Training programs contribute not only to the development of technical skills, but also to employees' sense of self-worth, which reduces the intention to leave.

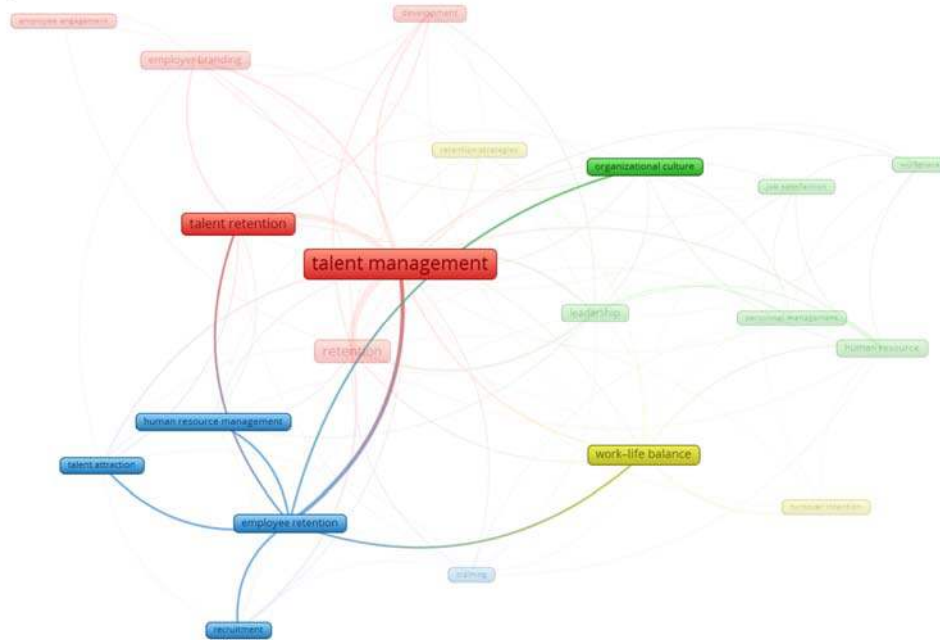
Another crucial aspect is talent attraction, which is the first step in building a stable workforce. Employer branding, coupled with a well-defined recruitment strategy, can position the organization as an attractive place for potential candidates. A solid talent attraction strategy not only brings the best professionals into the organization but also facilitates their long-term retention. Employees who feel they are in an environment that is compatible with their values and aspirations are less likely to seek other opportunities (Schein, 2010).

Human resource management (HRM) plays a key role in integrating these processes, from recruitment to retention. HR needs to implement adaptable policies that support both the attraction and development of talent in the context of dynamic changes in the labor market. For example, organizations that offer mentoring, upskilling and reskilling programs respond to the adaptive needs of employees and the organization, helping to increase retention.

Furthermore, a proactive approach to retention involves continuously analyzing employee needs and integrating them into customized programs. For example, providing constant feedback, recognizing merit and creating clear paths for career advancement are validated retention strategies.

Recruiting and attracting talent are not just entry points, but critical steps in building a stable workforce. Coupled with strong training and professional development initiatives, they become indispensable tools for employee retention.

Figure no. 4 Cluster 3 (Blue)



Source: VOSviewer

3.4. Cluster 4 – Retention Strategies and Work-Life Balance (Figure no. 5.)

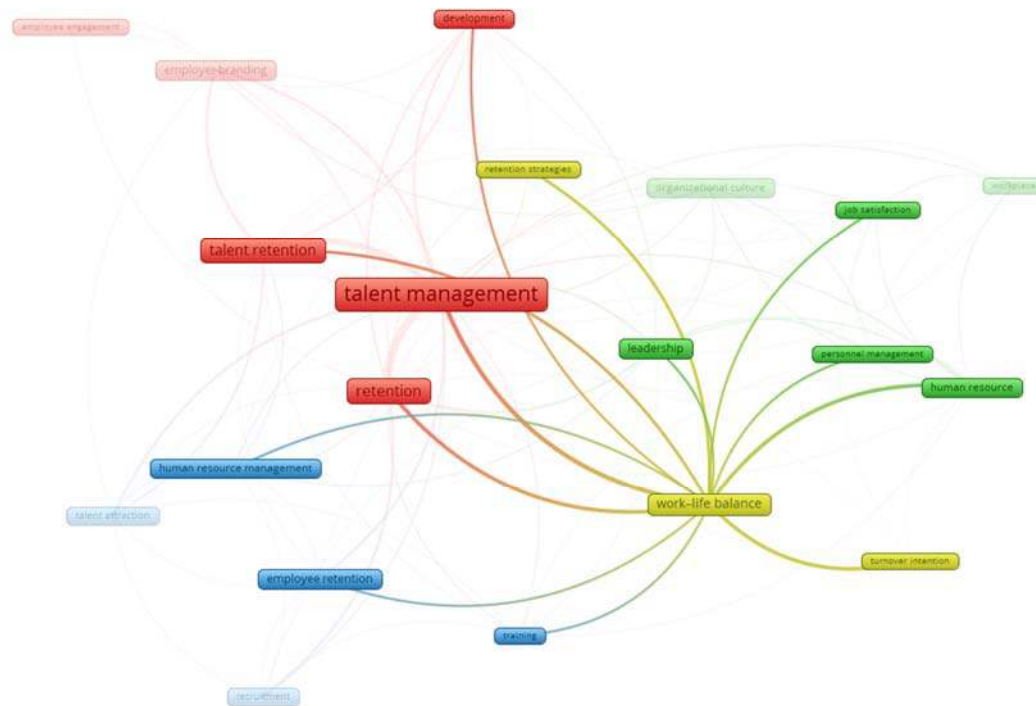
Retention strategies are fundamental to reducing turnover and retaining ones talent within organizations. In the literature, effective strategies focus on meeting the diverse needs of employees, including issues such as organizational culture, professional development, and customized benefits programs. Perceived fairness in treatment and reward is a critical element for the success of these strategies, directly contributing to reduced departure intentions.

Turnover intention is a significant indicator that reflects the level of employee dissatisfaction. Research underlines that a considerable proportion of employees who express a desire to leave are influenced by factors such as stress at work, lack of career advancement prospects or work-life imbalance (John, et al., 2020). A proactive approach to talent retention involves identifying and addressing these factors before the intention materializes.

Central to modern retention strategies is work-life balance. Programs that offer flexibility to employees, such as hybrid work or customized leave, significantly increase satisfaction and loyalty. In addition, implementing policies that support stress management, such as mental health support or wellness initiatives, help to create a more supportive and attractive work environment for talent (Poelmans, et al., 2013).

Work-life balance is a central pillar in modern retention strategies, helping to reduce the intention to leave. Organizing an environment that supports flexibility and mental health is key to creating a loyal and high-performing workforce.

Figure no. 5. Cluster 4 (yellow)



Source: VOSviewer

This clustered approach provides a deep understanding of the literature, highlighting the correlations between different aspects of talent retention. The use of VOSviewer facilitated a clear structuring of the themes, allowing not only the analysis of the terms, but also their integration into a holistic model applicable in practice.

4. Findings

The results of the analysis were graphically represented by concept maps, highlighting the interconnections between the analyzed terms. This method allowed a clear understanding of how talent retention concepts are associated with organizational culture, work-life balance, employee reward and digitalization. The analysis identified four main thematic clusters (Figure no.1):

1. Cluster 1 (Red):

This cluster focuses on developing management decisions related to talent retention, employee engagement and employer branding. It highlights the importance of strategies that enhance employee motivation and loyalty through effective communication of organizational values.

2. Cluster 2 (Green):

Addresses organizational culture, job satisfaction and leadership strategies. The cluster emphasizes the critical role of transformational leadership in creating a supportive organizational environment capable of retaining valuable talent.

3. Cluster 3 (Blue):

Focuses on decisions related to recruitment, talent attraction and professional development. The cluster emphasizes the importance of integrating recruitment and continuous development processes to ensure a stable and competitive workforce.

4. Cluster 4 (Yellow):

Includes retention strategies, intent to leave the organization, and work-life balance. It highlights that meeting individual employee needs through customized programs is key to reducing turnover.

It includes retention strategies, intention to leave the organization and work-life balance. It highlights that meeting individual employee needs through customized programs is key to reducing turnover.

These clusters provide an integrated perspective on the talent retention domain, demonstrating the interdependence between retention strategies and organizational and individual needs. The results underline that a holistic approach that combines the four identified strategies is fundamental to building sustainable and resilient organizations.

It can be seen that cluster 3 also emphasizes recruitment strategies, so retaining talent needs to start from the recruitment of new employees. Further the digitalization strategy is poorly researched. We can assume that by using digitalization we can more easily and efficiently identify the right people for a particular company. Digitization can also help us to possibly work in a hybrid system and thus be able to attract talented employees from outside the geographical area of the place of work.

Of course, the advantages presented by digitalization do not stop here, and the subject is still to be studied in more detail to see the totality of how digitalization can be involved in the human capital management process.

5. Conclusions

Talent retention is a strategic priority for modern organizations and is influenced by a number of interconnected factors. The VOSviewer cluster analysis allows us to identify four major directions that guide organizational efforts: professional development and employee engagement, organizational culture and leadership, talent recruitment and attraction, and work-life balance. The results confirm the complexity of the talent retention process and the need for integrated strategies.

The results show that professional development plays a key role in employee retention. Organizations that invest in training, mentoring and professional growth opportunities succeed in creating an environment in which employees feel valued and motivated to stay for the long term. Employee engagement, a concept closely linked to job satisfaction, is directly influenced by the level of recognition and support offered by the employer. At the same time, employer branding, perceived as a promise between the organization and its employees, contributes to building a relationship based on trust and loyalty. These elements are essential pillars for creating an attractive organizational environment that fosters retention.

Healthy organizational culture and transformational leadership are among the strongest retention factors identified in the study. The results underline that clear organizational values, support for diversity and inclusion, and a positive work environment increase employee satisfaction and reduce departure intentions. Organizational leaders play a central role, with the ability to shape culture and influence employee engagement. Studies show that transformational leadership - based on vision, inspiration and personalized support - creates a motivating work environment that fosters employee loyalty. Therefore, a well-defined organizational culture, combined with a tailored leadership style, becomes essential for talent retention.

Effective recruitment is the first step in the retention process. The results underline the importance of a well-defined recruitment strategy, including employer branding and a clear understanding candidates' needs and aspirations. Integrating them into the organization through effective onboarding programs and offering career growth prospects are key to reducing turnover. Continuous training and upskilling initiatives also respond to the changing demands of the labor market and contribute to long-term employee retention. Through a holistic approach, integrating recruitment and professional development, organizations can create a stable and competitive workforce (Urme, 2023).

Work-life balance is one of the most important factors in modern retention strategies. The results show that employees who take advantage of flexibility programs - such as hybrid work or personalized leave - show higher levels of loyalty and satisfaction. Initiatives that support employees' mental health and general well-being also contribute to a reduction in the intention to leave. Effective retention strategies need to be tailored to the diverse needs of employees and include proactive measures such as constant feedback, recognizing merit and offering opportunities

for advancement. These initiatives not only improve retention, but also help create a healthy organizational culture and an attractive work environment.

Organizations should adopt an integrated approach, combining professional development, organizational culture, strategic recruitment and work-life balance. This combination delivers more consistent talent retention results.

Digitization can accelerate the implementation of retention strategies by providing customized solutions for monitoring employee performance and satisfaction. Advanced technologies, such as artificial intelligence, can support the recruitment and development process while reducing the time and costs associated with staff turnover.

In a workplace where multiple generations coexist, it is essential that organizations tailor strategies to meet the specific needs of each demographic. For example, Generation Z places a strong emphasis on flexibility and technology, while Generation X values stability and recognition.

However, through bibliometric analysis we observe that one of the key strategies underlying talent retention is poorly addressed, namely digitization of staff. This topic appears in the context of other strategies such as hybrid working, but the VOSviewer software did not identify a cluster that would have digitization at its core, nor does this term appear in any other cluster.

Thus, we see in this paper that there is a link between rewarding employees and talent retention, through methods such as professional development, a topic discussed in Cluster 3.

In conclusion, talent retention is not just a tactical concern, but a strategic process, essential for organizational competitiveness and sustainability. Effective implementation of the identified strategies can turn retention from a cost into a long-term competitive advantage.

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Smart Packaging Main Trends

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Abstract

Globalization, innovative technologies and the ever-increasing demands of consumers have a significant influence on the packaging industry, which is constantly growing. Smart packaging is that which integrates technological elements to provide additional information about the product or to improve the user experience. Current trends in product packaging are characterized by a balance between innovation, sustainability and consumer experience. From the use of ecological and innovative materials to the creation of interactive, personalized and authentic packaging, the packaging industry is evolving rapidly, responding to market demands and environmental challenges. The present work aims to present these and to draw attention to the importance of this industry while highlighting some necessary aspects in consumer education, especially with regard to CPG. In this regard, the main trends have been identified and the main forms of materialization regarding smart packaging have been presented.

Key words: smart, package, innovation, sustainability.

J.E.L. classification: L66, O14, O32, Q01, Q55.

1. Introduction

Over the years, various product packaging trends have evolved internationally, with the aim of offering customers a new experience. It is clear that smart packaging can bring many benefits to the various links in the supply chain, such as the ability to quickly remove and replace packaging containing products in poor condition within a batch. In addition, this type of packaging also allows the quality of a packaged product to be analyzed much more quickly and economically.

(<https://www.spg-pack.com/fr/blog/emballage-intelligent-represente-veritable-revolution-secteur/>)

As more and more businesses embrace e-commerce, which has seen tremendous growth in recent years, companies have paid increasing attention to e-commerce packaging to ensure that products reach their recipients safely, improving the customer experience.

Smart packaging is a container capable of monitoring the condition and quality of products during storage and transport. It is an evolution of traditional packaging that will detect and record changes in the product's environment; it is a major step forward for the industry, particularly in the food sector. (<https://www.mecalux.fr/blog/emballage-intelligent>)

Smart packaging helps improve merchandise management because it is developed specifically to reduce waste, improve food safety, and ensure maximum product quality. However, its cost makes it difficult to popularize, despite its undeniable advantages. As this type of packaging becomes more widespread, both companies and consumers will benefit. Supply chain management will also be much smoother and more efficient, as warehouse managers will have all the information they need to ensure optimal storage and shipping conditions.

(<https://www.mecalux.fr/blog/emballage-intelligent>)

Current trends in product packaging are characterized by a balance between innovation, sustainability and consumer experience. From the use of eco-friendly and innovative materials to the creation of interactive, personalized and authentic packaging, the packaging industry is evolving rapidly, responding to market demands and environmental challenges.

In recent years, the packaging industry has incorporated revolutionary technologies that could take the world of packaging to the next level, and smart packaging is a good example of this. If the main function of packaging is to preserve food in optimal conditions, smart packaging is responsible for transmitting this information to the consumer by providing more data on the state of the food. (<https://www.spg-pack.com/fr/blog/emballage-intelligent-represente-veritable-revolution-secteur/>)

2. Theoretical background

Smart packaging represents a new approach to emerging technologies in the packaging industry that ensures both increased consumer satisfaction and business success. Although the concept of smart packaging is still new, the concept includes various technologies designed to achieve more than just packaging. (Greaves, 2024)

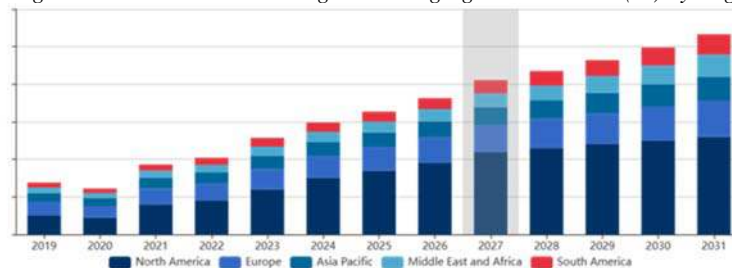
This type of packaging provides for products buyers real-time information and includes digital identifiers such as quick recognition (QR) codes, barcodes or radio frequency identification (RFID) technology; in this way, retailers can also obtain data throughout the technical circuit.

As these packaging technologies gain traction, their market is growing and is expected to reach \$38.3 billion by 2033, with a compound annual growth rate (CAGR) of 4.5%. (<https://customboxesnow.com/blog/what-is-smart-packaging/>)

Cognitive Market Research has recently published the 7th edition of *Smart and Intelligent Packaging Market Report 2024*. Quantitatively, it provides quantitative data, current market size, competitor market shares, market forecast and other industry updates at global, regional and country levels. Qualitative data refers to market drivers, constraints, current trends, opportunities and more. (Deore,2024)

The forecast refers to the evolution of revenues until 2031 at international, regional and country levels and analyzes the main recent trends for each smart packaging application. On this basis, the demand for smart packaging for various end-use industries can be analyzed, as shown in the figures below:

Figure no. 1. Smart and Intelligent Packaging Market Share (%) by Region (2019-2031)

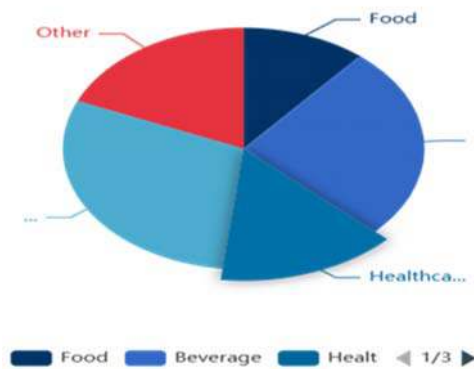


Source: Smart And Intelligent Packaging Market Report 2025/ Global Edition

The global smart packaging industry is growing as more brands embrace this cutting-edge technology. A recent report by Data Bridge shows that the global packaging market will grow by 7.4% by 2027, reaching \$31.94 billion.

Given the success of the application of these technologies, studies conducted predict a sustained development of the smart packaging market in the long term.

Figure no. 2. Smart And Intelligent Packaging Market Share (%) by Application in 2023-2031



Source: Smart And Intelligent Packaging Market Report 2025/ Global Edition

The conclusion is that the global smart packaging market is experiencing significant growth in the near future, especially the Active Packaging segment. Furthermore, the food segment is expected to experience significant expansion in this regard. In this respect, many companies in the field will focus on strategies to consolidate their product portfolio to expand their businesses in the global market. (Deore, 2024)

In the context of the constant growth of the packaging industry, technological innovations play also an essential role. According to a study, the quality of logistics services significantly influences the level of customer satisfaction and customer retention rate in e-commerce. This is vital for the smart packaging industry, which strives to improve user experience by integrating advanced technologies. (Micu et al, 2013)

Furthermore, the importance of business modeling for the circular economy must be emphasized, a principle that can also be applied to the development of sustainable packaging. (Herciu et al, 2023)

Additionally, consumer trust in artificial intelligence algorithms used in e-commerce should be highlighted, being a factor to consider when designing smart packaging that aims for personalization and interactivity. Therefore, it is important to educate consumers about the benefits and complexities of smart packaging to support its widespread adoption. (Teodorescu et al, 2023)

3. Research methodology

This paper aims to provide an overview and analysis on the role and importance of smart packaging. The main method used is qualitative research using documentation that aims to highlight the trends and benefits that this approach could bring to an organization and to society in general. The information necessary to conduct this research was accessed through documentary research as the main theoretical basis but also support for starting investigations at the level of the smart packaging industry.

The research highlights the clear growth trends of the smart packaging market and suggests that most companies that sign up in this direction will register clear gains and should be more involved in communicating both the social responsibility initiatives that this approach implies.

4. Findings

The research showed that although smart packaging applications are still in their early stages, the integration possibilities of these new practices are significant. This concept offers packages with extended functions, including various technologies designed to do more than just packaging, with benefits for both consumers and distributors of the products concerned.

We can take into consideration two types of smart packaging: active and intelligent. Active packaging interacts with the contents of a package to extend shelf life, often used in food packaging. This includes integrated ethylene absorbers, light filtering materials, oxygen absorbers, moisture control inserts, or antimicrobial coatings.

To communicate vital information such as product temperature, storage time or handling maneuvers, sensors and indicators are used in the smart packaging sector. Examples of this include time-temperature indicator labels. (<https://customboxesnow.com/blog/what-is-smart-packaging/>)

The main advantages of smart packaging, could be listed as following:

- *Customer empowerment*- through the digital indicators mentioned above;
- *Quality control*- and monitoring the various stages of product quality to correctly indicate their shelf life;
- *Staying relevant with customers*- due to an improved experience due to the information provided to potential consumers ;
- *Improved inventory management*- by stocking a quantity of goods to meet demand;
- *Greater sustainability*- by providing additional information on environmental protection;
- *Creating Theft, Substitution, and Counterfeit-Proof Products*- by improving the experience of tracking and communicating product status;
- *Predictive Planning*- by giving suppliers the opportunity to more quickly understand details related to product availability;
- *Brand Transparency*- considering the importance of raising consumer awareness regarding the economic, social and environmental impact;
- *Increasing Likelihood of Positive Experience*-. because customers have the opportunity to be active and increase their knowledge of the products they want to purchase and introducing a smarter way to package software. (<https://impacx.io/blog/what-is-smart-packaging-and-its-benefits/>)

From another point of view, smart packaging can be divided into two major categories, structurally functional and materially functional. This classification takes into account the general functions related to identification, detection, recording, tracking, but also the advantages of smart packaging compared to traditional packaging. These advantages refer to increasing logistical efficiency, quality control, supporting consumer rights and interests, or reducing environmental pollution. (<https://ro.wxsmartbag.com/news/two-major-types-of-smart-packaging-71397742.html>)

The evolution of various product packaging trends has also taken place in many CPG (Consumer Packaged Goods) brands internationally, with the aim of offering customers a new experience. CPG are items used daily by average consumers that require routine replacement or replenishment, like food, toilet paper, or cosmetics. The CPG industry is one of the largest sectors in the U.S. economy and the name originates in their packaging, which traditionally is easily recognizable wrapping that consumers can quickly identify on store shelves. (Bloomenthal, 2024) (<https://ecommerce-platforms.com/ro/glossary/what-is-cpg>)

Within the smart packaging market, there are several sectors, such as food & beverage, healthcare, automotive, personal care and others. Food & Beverage is the dominant sector and it is estimated that this trend will continue in the 2025-2030 time horizon. This evolution is undoubtedly the consequence of the growing need felt in terms of smart packaging solutions due to the previously presented advantages regarding the quality and safety of consumption and the requirements of environmental protection. (Chaudhary, 2023)

In practice, several types of smart packaging are used, incorporating different systems. We can thus find:

- Identifiers: the most common type of smart packaging, which although not very innovative, are able to provide more information to the consumer and which usually integrate a QR code in which the traceability or origin of the product can be quickly verified;
- Indicators: which indicate changes related to the temperature or freshness of food, interruptions in the cold chain or the degree of maturity of a fresh product;
- Sensors: which allow the detection of biochemical compounds secreted by food when it begins to degrade.

(<https://www.spg-pack.com/fr/blog/emballage-intelligent-represente-veritable-revolution-secteur/>)

There are thus many types of smart packaging, the main trends recorded should be highlighted, as follows:

- *anti-counterfeiting packaging*: this type of solution involves QR code-based identification, which can guide and help the end user and the company's salesperson to scan and identify the authenticity of a product using smartphone devices;
- *sustainable packaging*: along with ecological packaging, they represent essential concepts in the current context of environmental protection and increasing consumer demands regarding the impact that products and their packaging have on the quality of life;
- *minimalist packaging*: this trend is increasingly popular among brands that want to convey a message of elegance, quality and authenticity;
- *storytelling packaging*: represents an innovative approach to packaging design, which integrates narrative elements to create an emotional connection between the product and the consumer, including through personalized packaging that reflects special moments or events or story elements about the brand's tradition and history;
- *packaging that can collect feedback*: involves the integration of interactive technologies or QR code or AR (augmented reality) elements on packaging, which allow brands to interact directly with consumers and collect real-time feedback about the product or consumer experience;
- *customized packaging*: which helps differentiate products while also contributing to building an emotional connection between brand and customer;
- *functional packaging*: those that, along with product protection, improve the consumer experience through more practical and easy-to-handle use, being not only attractive but also economical, reducing waste and maximizing value for consumers;
- *zero waste packaging*: which promotes waste reduction and material reuse.

Another perspective identifies three other types of smart packaging:

- Consumer engagement - educational, entertaining or as part of a loyalty program.
- Product authentication and brand protection - for brands looking to highlight a product's authenticity or sourcing story, connected packaging can be used to provide detailed information unique to that individual item.
- Track and trace - tracks the journey of a package (and product) from start to finish.

(<https://epacflexibles.com/what-is-smart-packaging/?srsltid=AfmBOoph16AYMtVKDgkxf4wazcoEIHH8TfiMzHj8w483EI9GddzuHmzS>)

Along with the aspects presented, other trends can be highlighted, such as:

- *automation and innovations in packaging production*: advanced technologies, such as 3D printing and robotics, allow the creation of more complex and/or personalized packaging in a shorter time, while also helping to reduce material waste;
- *transparent versus opaque packaging*: this trend emphasizes the importance of transparency and brand trust;
- *active packaging*: food packaging that can extend the shelf life and thus reduce food waste and contribute to increasing demand.
- *using biological packaging materials*: such as mushrooms instead of polystyrene or beverage containers made from algae. (<https://www.sustainable-futures2030.org/rapoarte/>)

Sustainability must continue to be a key focus for the packaging industry. It is important for every business to adopt initiatives across the entire product lifecycle to align with the demands of the circular economy. As more and more businesses embrace e-commerce, which has seen tremendous growth in recent years, companies have paid increasing attention to e-commerce packaging to ensure that products reach their recipients safely, improving the customer experience.

5. Conclusions

Practice validates the undeniable benefits of smart packaging by providing sustainable ways to extend the functionality of product packaging to meet implicit or explicit needs. Thus, consumers will be faced with accepting additional benefits and, sometimes, changing old habits. In turn, companies will need to identify technologies that work and can ensure differentiation from competitors.

However, the high price is the main difficulty that still delays the widespread use of smart packaging. It is estimated that in the near future new high-performance technologies will be developed, which will allow reducing production costs and will allow the widespread use of smart packaging in all fields, for the most diverse products.

It can thus be appreciated that the global smart packaging market will register significant growth in the near future. The food segment is expected to expand to a significant position.

In this context, most of the key companies are focusing on their own strategy building models to strengthen their product portfolio and expand their businesses in the global market.

In conclusion, current trends in product packaging are characterized by a balance between innovation, sustainability and consumer experience. From the use of eco-friendly and innovative materials to the creation of interactive, personalized and authentic packaging, the packaging industry is evolving rapidly, responding to market demands and environmental challenges.

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Online Reviews in Romania: Motivations, Perceptions, and the Impact of the J-Shaped Distribution on Consumer Behavior

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Abstract

Online reviews are an important and powerful element of digital marketing, influencing consumer decisions and the reputation of products and services. This study analyzes the behavior of Romanian consumers in writing online reviews, with a particular focus on the "J shaped distribution", characterized by the preponderance of extreme ratings (5 stars or 1 star) and a limited representation of moderate reviews (2, 3 or 4 stars).

The results provide valuable insights into the motivations and preferences of Romanian consumers, contributing to a deeper understanding of the dynamics of online reviews. The study also highlights the role of moderated reviews in strengthening consumer trust and supporting informed decision-making. These conclusions address both the academic literature and digital marketing professionals, providing practical directions for effectively managing online reviews and increasing consumer engagement.

Key words: online reviews, consumer behavior, e-commerce, digital marketing.

J.E.L. classification: M31

1. Introduction

With the evergrowing digital space of e-commerce, online reviews quickly became a one of the biggest elements in the consumer decision-making process, having a significant impact on the perception of the quality of products and services. In this online and non-tangible space, user's reviews act as a credible source of information for consumers. This is also true for Romanian consumers, as online reviews have a major influence on buying behavior, especially in the most popular e-commerce platforms on a national scale.

However, when analyzing the distribution of these reviews, we can observe a very interesting phenomenon, known in the literature as the „J-shaped distribution”. This implies that most of these reviews are on the extremes of the rating spectrum, either very positive reviews, with a 5-star rating, or very negative ones (1 star), while moderate reviews (2,3,4 stars) have a smaller number. This form of distribution rises questions about the motivations behind writing reviews and their relevance as objectively representing consumer experiences.

The goal of this research is to explore the various factors that can influence the Romanian consumer's decision on writing online reviews, with an emphasis on their perceptions and motivations. It also aims to underline the importance of moderate reviews for a realistic and balanced image of various products and services. With the help of a questionnaire, this research analyzes the behaviors and preferences of Romanian consumers, aiming to offer an empirical perspective on this phenomenon and contribute to the digital marketing and consumer behavior literature.

2. Theoretical background

Online reviews are an effective form of electronic consumer-to-consumer communication, having a profound influence on the decision-making process. They are perceived as more authentic than traditional advertising messages, being considered a form of electronic word-of-mouth (eWOM) (Chevalier & Mayzlin, 2006; Dellarocas, 2003). Consumers turn to online reviews to evaluate the quality of products and services, especially in the e-commerce environment, where there is no direct interaction with the product before purchase. In this context, reviews function not only as sources of information, but also as factors that influence trust and perception of risk associated with a purchase (Park & Lee, 2009).

The "J-shaped distribution" is a widely spread phenomenon in online reviews analysis and is characterized by a preponderance of extremely positive or extremely negative reviews, with a few occurrences of moderate ones. This pattern is explained through consumer's motivations behind those reviews. Research shows that consumers who experience exceptional experiences, whether positive or negative, are more inclined to share them compared with those who experience neutral or average experiences (Anderson, 1998). This fact can be attributed to the desire to reward an extraordinary experience or to express dissatisfaction with an experience perceived as unacceptable. Similarly, studies imply that moderated reviews are less common because they do not provide a compelling or memorable enough story for authors to consider them worthy of publication (Hu et al., 2009). In consequence, their absence can affect the perception of a product or service, creating a distorted image of its quality.

The actual motivations of consumers to publish reviews are influenced by several factors, from extreme satisfaction or dissatisfaction, ease of publishing process, the existence of incentives and the desire to help other consumers (Hennig-Thurau et al., 2004). Also, their curiosity to see companies' response and direct requests from them can increase the likelihood of a review being published (Sparks & Browning, 2011). The importance of available time and external influences such as social pressure or cultural trends can also play a significant role in this process (Berger, 2014).

Moderated reviews are considered an important piece of for a balanced and genuine perspective of products and services. They provide a realistic image on strengths and weaknesses, reducing the polarization induced by extreme reviews (Mudambi & Schuff, 2010). More so, research indicates that moderated reviews help can increase consumer trust by providing a more complete framework for informed decisions (Liu, 2006).

3. Research methodology

Our study was designed to analyze the behavior of Romanian consumers in relation to online reviews, with a specific focus on their "U" shaped distribution. For this purpose, a quantitative approach was used, based on the collection of data through a structured questionnaire. This method allows for a systematic and comparable examination of participants' responses, thus providing a solid basis for interpreting the results. The study used a questionnaire developed based on the specialized literature, including closed questions and a Likert scale to assess consumer attitudes and behaviors. The questions in the questionnaire addressed the following aspects:

- Determinants in the decision to publish a review (eg extreme satisfaction, incentives, company request).
- Likelihood to write reviews for experiences of moderate intensity (eg acceptable but not outstanding experiences).
- Opinions about the relevance of moderated reviews in creating an objective image of products/services.

The questionnaire was distributed online, on social media platforms, chatting servers and forum boards in order to reach a diversified sample, representative of the active online population in Romania.

The sample included 100 respondents from Romania, selected through the convenience sampling method. To ensure data relevance, active online consumers who had made purchases of products or services in the last six months were targeted. Respondents were recruited by distributing the questionnaire on social media platforms and through direct emails addressed to users of e-commerce platforms.

The questionnaire was administered online, using a research platform easily accessible to respondents. The questionnaire was distributed over a period of two weeks, providing sufficient time to obtain a representative sample. Participation was voluntary, and respondents were assured that their responses were anonymous and confidential. The collected data were analyzed using descriptive and inferential statistical methods. Frequency distribution was used to identify the most frequently mentioned factors, and Likert score analysis allowed determining trends in responses regarding the likelihood of leaving reviews in different situations. Correlation tests were also applied to examine the relationships between variables, as well as chi-square analysis to assess significant differences between subgroups. One of the main limitations of the study is the use of convenience sampling, which may introduce a degree of subjectivity and limit the possibility of generalization to the entire population. In addition, being a self-report study, there is a risk of social bias in the participants' responses.

The adopted methodology provides a robust framework for investigating Romanian consumers' behavior regarding online reviews. The analysis of the results will allow for a deeper understanding of their motivations and perceptions, contributing to the specialized literature and to the development of marketing strategies adapted to the local market.

3. Findings

Extreme Dissatisfaction (64%) Extreme dissatisfaction is the most common reason consumers choose to write a review. This finding supports the theory that negative experiences have a stronger impact on consumer behavior than positive ones, a phenomenon known as negativity bias (Anderson, 1998). Disappointed consumers are more likely to post reviews to express their frustration, warn other consumers, or draw the company's attention to problems they have encountered.

Available Time (52%) The second most important factor is time available. This highlights the fact that while the intention to leave a review may exist, consumers are constrained by their time resources. Respondents who cited time as a determining factor are likely to be more inclined to leave reviews when the process is fast and efficient.

Extreme Satisfaction (34%) Extreme satisfaction is another important factor that determines consumer behavior. Similar to extreme dissatisfaction, positive experiences are more likely to generate reviews, especially when the product or service exceeds expectations. Satisfied consumers are more likely to express gratitude or recommend the product to others.

Existence of an incentive (32%) Incentives, such as discounts, loyalty points or rewards, were mentioned by 32% of respondents as a reason for writing reviews. This result suggests that such benefits can encourage active review behavior, especially for consumers who would not normally write reviews.

Ease of leaving a review and product/service quality (30%) Ease of posting and product/service quality were mentioned by 30% of respondents, indicating the importance of user-friendly platforms and well-made products in stimulating review behavior. E-commerce platforms that facilitate review writing (e.g., simple and intuitive interfaces) may benefit from a higher volume of user feedback.

Desire to help other consumers (28%) The altruistic desire to contribute to the consumer community is another important reason. This factor shows that a significant segment of respondents perceive review writing as an action of support for others, thus strengthening the dynamic of consumer-to-consumer communication.

External influences and curiosity (4%) External factors, such as social pressure or curiosity to see how companies respond, were mentioned by a small percentage of respondents (4%). This suggests that such motivations have low relevance for the majority of Romanian consumers.

Company request (6%) Direct requests from companies are rarely perceived as a primary reason for writing reviews. This result indicates that such initiatives need to be combined with other strategies (e.g. offering incentives) to become effective.

The survey results show that most Romanian consumers are not very receptive to requests from companies to leave online reviews. Over a quarter of respondents (26%) said they are "not at all likely" to respond to such a request, and another 20% indicated that they are "unlikely." This reluctance suggests that direct requests from companies are not convincing enough, especially if they do not offer a clear benefit or are not adapted to the consumer's personal context.

However, the largest segment of participants (28%) adopted a neutral position, indicating that they could be influenced to respond by well-targeted messages or incentives, such as discounts or symbolic rewards. Only 18% of respondents said they were "likely" to leave a review, and a small percentage (8%) said they were "very likely" to respond. This group, likely made up of loyal or highly satisfied consumers, presents an opportunity for companies to create brand ambassadors through strategies that engage them.

Overall, the results highlight that simply asking for a review is not enough to drive a meaningful response. Companies should personalize their messaging, clearly explain the benefits of reviews, and simplify the process of posting. Using moderate incentives can also turn reluctance into engagement, especially among neutral or unlikely-to-respond groups. These measures can not only increase the number of reviews, but also help diversify them, providing a more balanced picture of consumer experiences.

When asked, on a scale from 1-5, how likely would they write a review for a mediocre experience with a product or service, the results show a clear tendency for consumers to avoid writing reviews for products or services that provide a mediocre or acceptable, but not outstanding experience. The majority of respondents (40%) said they are "not at all likely" to write such a review, reflecting the fact that these experiences are not significant enough to motivate action. In addition, 18% of respondents consider it "unlikely" to provide feedback in these circumstances, reinforcing this tendency to avoid.

A low percentage (8%) indicated a neutral position, suggesting limited motivation or lack of a clear drive to document such experiences. In contrast, 18% of respondents say they are "likely" to write a review for a mediocre experience, and 16% say they are "very likely" to do so. These consumers, although fewer in number, represent a valuable segment that could be encouraged to contribute to diversifying reviews through specific strategies. These results confirm observations in the literature that extremely positive or extremely negative experiences are the ones that most frequently generate reviews, while moderate experiences are often overlooked. This dynamic contributes to the J-shaped distribution of online reviews, where middle-of-the-road reviews (2, 3, or 4 stars) are underrepresented.

To incentivize consumers to leave reviews for moderate experiences, companies should implement tactics that appeal to this less motivated segment. Simplifying the writing process, offering symbolic rewards, or emphasizing the importance of moderate reviews in creating a realistic image can be effective solutions. In conclusion, encouraging consumers to document acceptable but unimpressive experiences could help create a more balanced review base that is more representative of the reality of user experiences.

The majority of respondents (74%) believe that moderated reviews (2, 3, 4 stars) are essential for a more accurate representation of reality, underlining their awareness of their value in highlighting both the strengths and weaknesses of a product or service. However, 26% of participants do not consider these reviews necessary, likely influenced by the tendency to prioritize extreme experiences, positive or negative.

This discrepancy between the appreciation of the usefulness of moderated reviews and consumer behavior reflects a common problem in the distribution of online reviews. Although moderated reviews are recognized as important, they are often underrepresented. Companies could address this imbalance through strategies that highlight the role of these reviews in informing other consumers and by offering symbolic benefits to encourage their writing.

In conclusion, there is a majority consensus on the need for moderated reviews, but companies must actively intervene to transform this perception into behavior, thus contributing to diversifying and balancing online reviews.

4. Conclusions

The study highlights the complex dynamics of Romanian consumers' online review behavior and their relevance in the decision-making process. The results confirm the trends observed in the specialized literature, where extreme reviews (positive or negative) are dominant, and moderate ones are underrepresented, contributing to the typical "J"-shaped distribution of ratings.

A key aspect identified is that extreme experiences, either satisfaction or strong dissatisfaction, represent the main motivations for writing reviews, suggesting that only outstanding experiences lead consumers to actively engage. However, moderate reviews, although recognized by 74% of respondents as important to better reflect reality, are rarely written. This difference between perception and behavior reflects a lack of clear motivation for consumers to document average or acceptable experiences.

When it comes to companies' requests for reviews, consumers are generally reluctant, with nearly half of them considering it "not at all likely" or "very unlikely" to respond to such initiatives. However, a significant segment of neutral or likely-to-responders could be activated through better-tailored strategies, such as personalizing messages or offering symbolic benefits.

Based on these findings, companies can take a more proactive approach to managing online reviews, focusing on reducing polarization and encouraging moderated reviews. This can be achieved by simplifying the writing process, offering incentives for balanced reviews, and promoting their importance in other consumers' decision-making. By balancing the distribution of reviews, companies will not only build a more authentic and credible image, but will also help build trust in e-commerce platforms and the online review process.

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Strategies for Increasing the Resilience of Agroecosystems through the Implementation of a Quality Management System

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Abstract

In the context of an increasingly competitive global market and the recognition of the vulnerabilities generated by the impact of the agricultural sector on the environment, the application of specific principles of a coherent quality management system is important to ensure long-term sustainable development. In this study, by means of bibliometric analysis, specific quality management principles are analyzed, with a focus on highlighting the links between them and the economic, social and environmental sustainability of the agricultural sector. Another point of interest is the determination of the impediments, in antithesis to the advantages of implementing quality standards, for achieving sustainable economic growth objectives. The outcome of this research validates the desirability of implementing quality management principles in the agricultural sector as the main direction of evolution towards responsible, efficient and sustainable agriculture.

Key words: agriculture, sustainable development, quality management, bibliometric analysis

J.E.L. classification: M21, M11, O13, Q01

1. Introduction

Under the impact of climate change, in correlation with the need to conserve natural resources globally, the agricultural sector is undergoing a process of structural transformation, with the main objective of ensuring the prerequisites for resilient and sustainable development. Global population growth, increasing world demand for food, growing urbanization, increasing scarcity of natural resources and the intensification of agricultural technologies are factors that generate the need for a coherent strategic vision at national, European and global level, oriented towards sustainable socio-economic development. According to the latest statistics, it is predicted that globally the demand for food will increase by 70% by 2050 Food and Agriculture Organization 2011). Analysis of global demographic trends shows an upward trend, with an estimated increase from 8 billion today to 10 billion by the middle of this century. Increased urbanization, coupled with accelerated economic growth in countries with large populations (e.g. Brazil, China, India and Russia), will increase pressure on natural resources. For the agri-food sector, these issues constitute both an opportunity and a challenge.

Agriculture plays an important role in Romania in terms of rural population size and employment. About 45.7% of the population in Romania lives in rural areas, compared to about 23.6% in the EU Member States. About 30% of the population is employed in the agricultural sector, compared to about 2% in the old Member States (EU-15) and 3-14% in the new Member States (EU-8) (MADR, 2015).

Romania's accession to the European Union (EU) 17 years ago, on January 1, 2007, marked the beginning of a new stage of economic development, centered on the principle of economic and social cohesion, emphasizing the promotion of conditions for economic growth, the reduction of regional development disparities, the assurance of a high level of employment and balanced and sustainable development. The allocation of financial resources through Community agricultural policies aims at the sustainable development of Romanian agriculture in the context of harmonization with the European model by increasing its compatibility and convergence with international quality standards, using strategies related to the reduction of the impact on the ecosystem and biodiversity conservation.

In this paper, we will use bibliometric analysis to study the influence of quality management in the agricultural sector, with the main objective of identifying the interdependence between the two concepts, highlighting their applicability and visibility in the scientific literature.

As a branch of information science, bibliometrics studies the quantitative measurement and analysis of scientific publications and other academic literature. Statistical indicators are used to assess research trends, relationships between authors, the value and impact of scientific research. By analyzing the number of publications, citations and co-authorship networks, researchers can uncover topical themes while identifying less studied aspects, thus generating opportunities for future research.

The aim of this paper is to identify and evaluate the impact generated by the implementation of a quality management system on the agricultural sector as a whole and to identify coherent and innovative strategies that facilitate the sustainable development of this sector. The influence of quality management in the agricultural sector is very complex and integrates concepts of food safety, sustainable development and economic performance. The implementation of international quality management standards increases the competitiveness of the agricultural sector in direct correlation with environmental and consumer responsibility. In the current context, characterized by a sharp increase in demand for food products, against the backdrop of increased urbanization, in contrast with the changing approach to responsible management of natural resources, quality management has an essential role to play in maintaining sustainability and food security at the global level.

2. Literature review

The concept of sustainable development implies the identification of directions and strategies to continuously improve the quality of life for present and future generations, with the aim of establishing viable communities capable of using natural resources responsibly and harnessing the capacity for ecological innovation, in order to ensure food security, biodiversity protection and social cohesion.

Addressing the quality of agricultural products and food in the current context in Romania requires an intense and long-lasting process, aimed at changing individual and collective mentality towards nutrition (Chira, 2010, p.5).

Standardization within an organization is very important nowadays, as to achieve this the organization has to manage different resources correctly on a daily basis. These resources include manpower, information, equipment and materials. Standards become an integrated part of an effective management practiced by organizations and provide the basis for the daily improvement of the company's business in all aspects (Dogaru, 2016, p.13)

In carrying out the present study, we have documented reference works in the literature, synthesizing the essential aspects related to sustainable development and the implications for the agricultural sector. Altieri's vision - sustainable agriculture is a method of agricultural production that aims to maintain long-term productivity by conserving natural resources, reducing pollution and integrating biodiversity (Altieri, 2018, p.23), emphasizes the need to harmonize production with environmental protection principles. Analyzing the innovation potential in the agricultural sector in relation traditional farming practices, Pretty describes agriculture as a process of transforming natural resources to produce goods and services, integrating traditional knowledge with modern innovations (Pretty, 2018, p.17)

In the research of the issue addressed, we also took into account the notions related to quality management, which is a concept of particular importance in various economic sectors, especially in the agricultural sector, where ensuring quality and food safety is important. According to the International Organization for Standardization, quality management is a set of principles and coordinated activities to direct and control an organization in terms of quality. According to Juran, quality management in agriculture means the application of standards and norms in the production processes in order to ensure an end product that meets the requirements of consumers while also respecting environmental regulations (Juran, 2023, p.45). Regarding the cohesion between sustainability and quality management, Deming describes Total Quality Management as a management philosophy that involves the entire organization with the aim of improving quality and reducing defects through continuous participation and learning process (Deming, 1982, p. 11).

3. Research methodology

The term "bibliometrics" was first used in 1969 by Alan Pritchard. Bibliometrics is defined as the application of mathematical and statistical methods to books and other media (Pritchard 1981, p.6). Bibliometrics is the quantitative analysis of written publications, such as books or articles, to analyze their impact, usage or dissemination patterns (Egghe L et al, 1990, p.8) As a research method, bibliometric analysis is the use of quantitative methods to identify correlations, assess the impact and emerging trends in scientific publications. The importance of bibliometrics as a research method lies in its ability to assess the performance of research in different fields, as well as to identify new directions of research. Currently, bibliometric analysis is an essential tool in promoting research performance and understanding the evolution of research in different fields of interest.

In the realization of this work, we used bibliometric analysis as a research method, in order to support a strategic study of the selected concepts and their visibility in the specialized literature. We used the Scopus database, recognized as one of the largest bibliographic and bibliometric databases in the world, constituting an indispensable tool in academic research. Scopus is an online bibliographic and bibliometric database of scholarly literature: scientific journals, books and international conference papers. Providing an overview of worldwide research results in scientific fields, Scopus offers intelligent tools to track, analyze and visualize research.

Taking into account the analytical nature of this paper, we applied a detailed methodology of querying and selecting information by identifying relevant publications, books, articles and papers in the field of agriculture and quality assurance. In more precise terms, we used as search keywords: "agriculture" , "quality management" and "sustainable development", to identify relevant articles, books and publications indexed in the Scopus database.

Table no.1 Analysis of variables

Variable	Value
Sources (articles)	207
Keywords	3474
Minimum number of occurrences of a keyword	20
Threshold	29

Source: Authors' own processing using VOSviewer

In addition to the bibliometric analysis, we used the VOSviewer software tool to identify the interdependencies and connections between scientific publications related to agriculture, quality management and sustainable development. This software offers possibility to visualize bibliometric maps, revealing the interconnections between the keywords identified in the selected publications and the correspondence between the analyzed concepts.

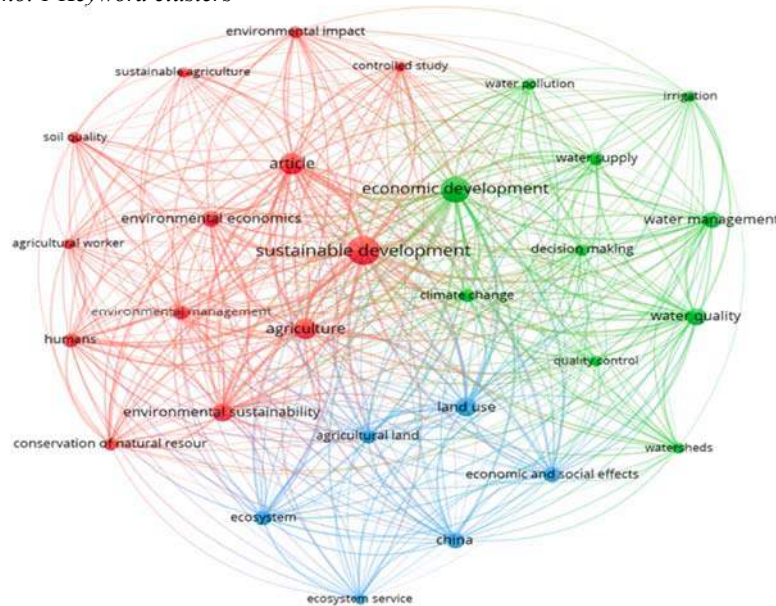
In order to deepen the analysis, we used a series of filters consisting of inclusion criteria - articles in English, articles in the final stage of publication, in direct correlation with exclusion criteria - review articles. The final data selection consisted of 207 articles, which were subjected

to bibliometric analysis using VOSviewer software. In the table 1 below, we have realized a presentation of the components of the selected sample.

4. Findings

In performing this bibliometric analysis, we used VOSviewer Visualization of Similarities Viewer) version 1.6.20 as a software tool for visualization and analysis of graphical maps based on scientific literature using data exported from the Scopus database. As a result of combining the notions of "quality management", "sustainable development" and "agriculture", we obtained a selection of 29 keywords through Vos Viewer. As a preliminary step, we carried out a filtering operation on the data obtained, by eliminating identical terms, i.e. adapting the terminology of the words used. We thus obtained three clusters grouping the selected terms, as can be seen in figure 1.

Figure no. 1 Keyword clusters



Source: Authors' own processing using VOSviewer

The first cluster (red) groups 13 keywords and focuses on the relationship between the sustainable development of the agricultural sector and environmental impacts. The theme of this cluster is represented by the concept of sustainability, with the central term "sustainable development", which is directly linked to terms such as "agriculture", "environmental impact", "conservation of natural resources". The connection between the terms "agriculture" and "environmental impact", "soil quality" reflects the interdependence between the functionality of the agro-ecosystem ensured through the responsible use of natural resources and the economic activities carried out in the agricultural sector. The complexity of the concept of sustainability and its broad scope of manifestation is highlighted by the interconnection between economic development and the environmental impact of agricultural activities, a relationship that places sustainable agriculture at the center of strategies to conserve biodiversity and ensure food security at the global level.

Analyzing the link between the terms "environmental impact", "agriculture" and "economic sustainability", we conclude that agriculture is a primary economic sector, closely dependent on environmental health and agro-ecosystem conservation.

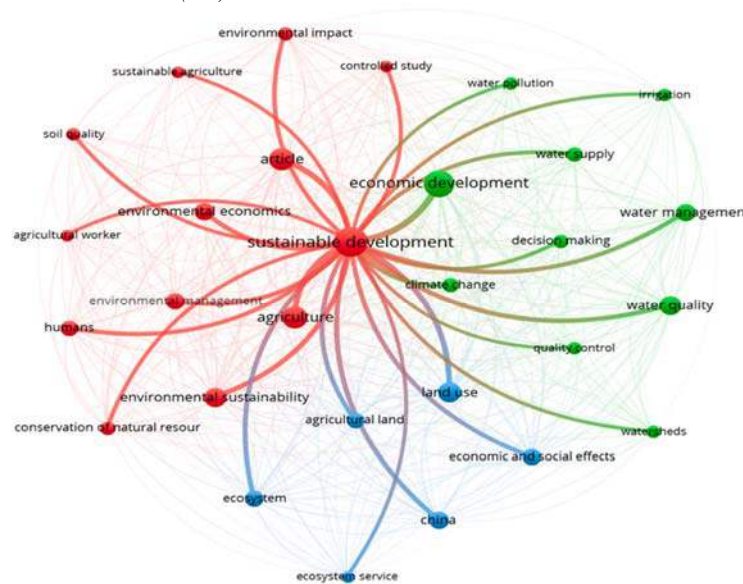
The sustainability of the agricultural sector implies the optimization of applied technologies and practices for the conservation and responsible use of natural resources. Through the implementation of a quality management system in the agricultural sector, these practices are incorporated into a set of agricultural production methods based on minimizing environmental

impact. The main objective is focused on sustainably increasing agricultural production, protecting natural resources, and ensuring safe and healthy food for consumers. By analyzing the connections between the terms, the red cluster highlights the shortcomings and development opportunities related to sustainable agriculture and minimizing environmental impacts.

Sustainable agriculture, seen as a lever of sustainable development, encompasses the full range of scientific (observations, measurements and experiments) and applied (analysis, design, management) activities in agriculture and other economic branches that process and commercialize agricultural and agro-industrial products and places particular emphasis on the valorization and conservation or restoration of natural, technical, financial and human resources specific to local and zonal agro-ecosystems (Ion Toncea et al. p 18, 2017).

The major challenge that the agricultural sector will face in the coming period is to identify and implement a quality management model that will allow organizations to focus simultaneously on both economic development and on meeting resilience and sustainability standards.

Figure no. 2 Cluster 1 (red)

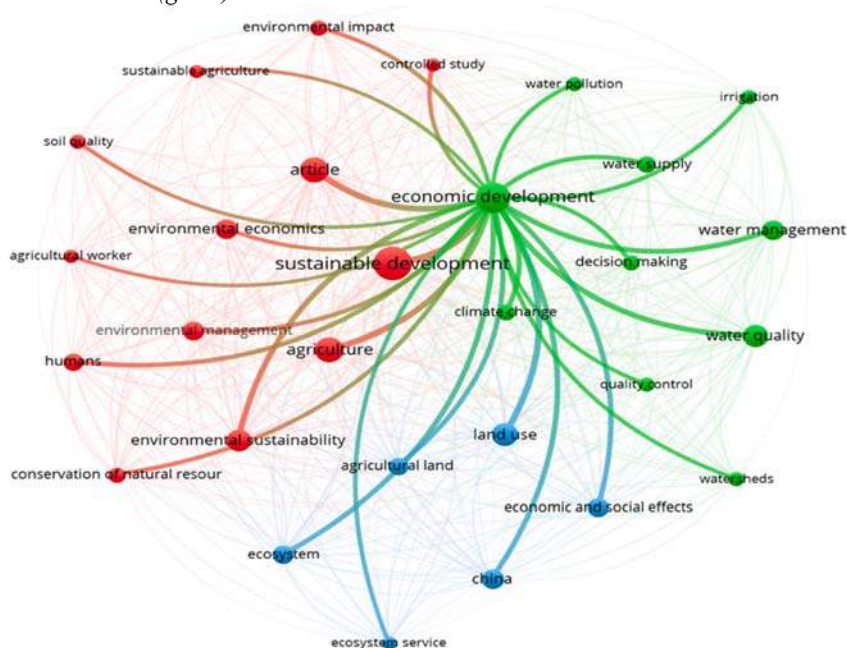


Source: Authors' own processing using VOSviewer

The second cluster (green) groups 10 terms in the field of the links between natural resource management, water resources management and quality and sustainable economic development. The specificity of this cluster is emphasized by its focus on the concept of "economic development", in direct correlation with terms in the field of responsible management of water resources - "water supply", "irrigation", "water pollution", "water management", in the conditions generated by the impact of climate change. As emphasized also in the interference between the clusters, the vital role of water in the agricultural sector, as an enhancer of production factors, defines the imperative need to implement a responsible management of this resource. Conserving agro-ecosystems and increasing their resilience to climate change, requires the preservation of water resources as the main means of ensuring sustainable development. The relationships between the terms "water management" and "economic and social effects" emphasize the importance and limiting character of water as a vital resource in sustainable economic development, suggesting the importance of concerns for ensuring water sustainability in the context of climate change. This approach is an integral part of a quality management system based on clear policies and accurate information in the decision-making process, which is emphasized by the connection between the terms "decision making" and "water management". The indirect connection between the terms "economic development" and "water management", respectively "water quality", reflects how the sustainability of water resources is influenced by the solutions

applied to water quality problems as part of the decision-making process. Therefore, the configuration of a quality management system that provides strategic directions for action to integrate sustainability as a priority action in water resources management is essential for the analysis and quantification of sustainable development indicators. The analysis of this cluster highlights the importance of knowing the interactions between sustainable development and natural water resources. At the center of the balance between economic needs and biodiversity conservation, water plays a crucial role in building global sustainability.

Figure no. 3 Cluster 2 (green)

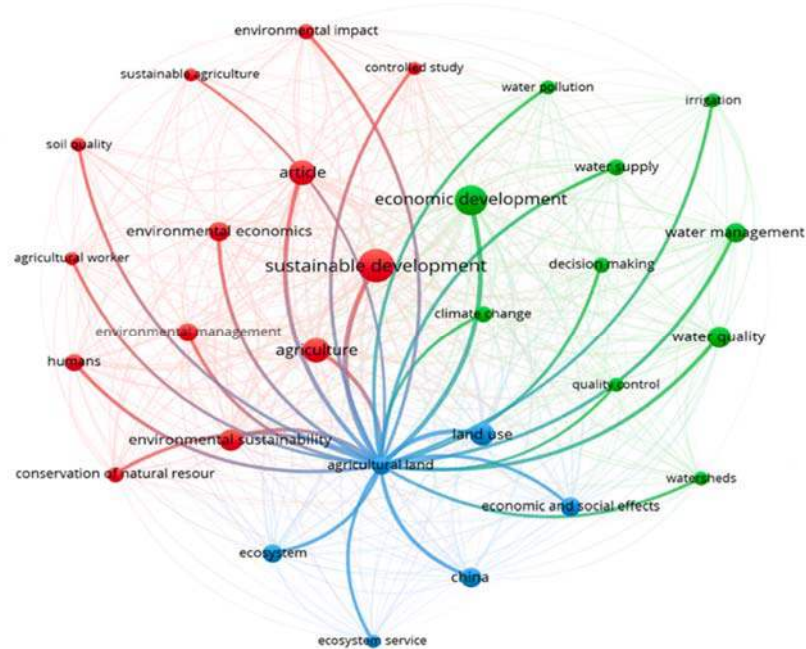


Source: Authors' own processing using VOSviewer

The third cluster emphasizes the opportunity of implementing a quality management system as an essential tool for planning and monitoring the sustainable use of agricultural land as the main production resource. The key words are represented by the terms "agricultural land", "land use", "ecosystem" and emphasize the need for a responsible and complex approach to agricultural activities, by ensuring the right premises for a sustainable economic and social development, in line with the objectives of ecosystem protection and biodiversity conservation. The term "land use" emphasizes the fact that the notions in the cluster quantify the impact of agricultural activities on land, generated by the intensification of production processes and the pressure induced by the accentuated dynamics of urban development. In conclusion, the implementation of a quality management system in the agricultural sector ensures the quantification of the economic value and ecosystem services generated, the assessment of the impact of climate change on land use and the analysis of the efficiency of environmental policies in ecosystem conservation.

The analysis of the three clusters, illustrates the complex nature of the concept of sustainable development and highlights the connections between: proper management of natural resources - "agricultural land", "water management", socio-economic impact - "economic and social effects" generated by the agricultural sector, correlated with monitoring the degree of achievement of biodiversity conservation objectives - "environmental impact" and increasing the resilience of agro-ecosystems "ecosystem service".

Figure no. 4 Cluster 3 (blue)



Source: Authors' own processing using VOSviewer

5. Conclusions

This paper studies the synthesis of specialized scientific literature, using bibliometric analysis as a research method, in order to identify the impact of scientific publications, emerging research trends and to determine future research directions in the field of quality management influence on the agricultural system

At the same time, the current study reflects the valuable resources generated by existing research, and the results of the present bibliometric analysis highlight as a future research direction the quantification of the benefits generated by the implementation of a quality management system in the agricultural sector, in terms of sustainable economic development, in direct correlation with the objectives of agro-ecosystems biodiversity conservation.

In conclusion, this paper illustrates a complex picture of the concept of sustainable development, emphasizing that economic emergence, equity and social welfare are the result of a complex system of natural resource management, starting from the basic principles of quality management in the agricultural sector. The economic efficiency of the agricultural sector and the responsible management of natural resources are converging directions of action to generate the prerequisites for sustainable development. It is necessary to re-evaluate the perspectives in the sphere of concrete actions to optimize the connections between the sectors involved, by setting clear objectives that ensure the equitable and simultaneous satisfaction of the environmental, economic and social needs of the community.

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Defining and Characterizing Women Entrepreneurship

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Abstract

Entrepreneurship plays a key role in sustaining economic development, ensuring economic growth, launching innovative products and/or services, and satisfying social needs of communities and/or societies. Last decades have witnessed the rapid development of women entrepreneurship all over the world. As women have been increasingly involved in business startup since the beginning of the 21st century, the number of women entrepreneurs has soared in most countries of the world. The paper aims to briefly define and characterize women entrepreneurship. To attain the purpose of the paper the author used a qualitative scientific research method. The paper contributes to the expansion of the scientific literature regarding women entrepreneurship. It analyses various definitions and identifies several main characteristics of women entrepreneurship.

Key words: women entrepreneurship, entrepreneurship, women entrepreneurs, women

J.E.L. classification: L26

1. Introduction

Entrepreneurship plays a key role in sustaining economic development, ensuring economic growth, launching innovative products and/or services, and satisfying social needs of communities and/or societies. Last decades have witnessed the rapid development of women entrepreneurship all over the world. In 2022, the global women's startup activity reached 10.1% against 12.7% for men (Global Entrepreneurship Monitor, 2023) and, in 2023, 10.9% women compared to 13.8% men (Global Entrepreneurship Monitor, 2024).

A plethora of factors, such as socio-economic progress, better access to education and higher urbanization, led to a spurt in women entrepreneurship. As women have been increasingly involved in business startup since the beginning of the 21st century, the number of women entrepreneurs has soared in most countries of the world. It is said that one in three businesses are owned by women at a global level (Halim, 2020) which demonstrates their contribution to increasing economic development worldwide (Brush *et al*, 2012; Sajjad *et al*, 2020).

This is why encouraging and supporting women to set up their own businesses and become entrepreneurs constitutes an important issue in the policy-makers agenda. In this respect, the European Union (EU) created the online-platform WEgate and the Enterprise Europe Network (EEN) in order to support women entrepreneurs (WEgate, 2024) and to facilitate the connections among them (Enterprise Europe Network, 2024), and the World Bank launched the Women Entrepreneurs Finance Initiative (World Bank Group, 2024). Moreover, numerous studies about women entrepreneurship and women entrepreneurs have been published in recent decades (Fischer *et al*, 1993; Shelton, 2006; McGowan *et al*, 2012).

The paper aims to briefly define and characterize women entrepreneurship. This study is structured as follows: the theoretical background is displayed in the second part. The next part of the paper illustrates the research methodology. The findings are presented in the fourth part. The conclusions are shown at the end of the paper.

2. Theoretical background

In the past decades, women entrepreneurship has increasingly become a subject of interest for researchers and practitioners all over the world. Numerous studies regarding this topic have appeared in the literature as women entrepreneurs play an important role in the global economy (Organisation for Economic Co-operation and Development, 2021). For example, they are job creators and income generators (International Finance Corporation, 2024).

Originating in the United States of America (Jennings *et al*, 2013), the field of women entrepreneurship emerged in the 1970s (Yadav *et al*, 2016). Women entrepreneurship is defined as:

- “an act of owning a business which makes women economically independent” (Chhabra *et al*, 2020, p.77).
- „an expansive concept much more profound than the merging of ‘women’ and ‘entrepreneurship’” which „signifies a move towards the path of empowerment, approaching the world of business through innovation and a distinct outlook” and it is about “women taking charge in the business world, exploring opportunities and driving their companies towards success” (Stewart, 2023, p.1).
- “the process of creating, managing, and developing a business enterprise by a woman or group of women” which “involves the identification of opportunities, developing and executing business strategies, managing financial resources, and taking calculated risks to achieve business objectives” (Geektonight, 2024, p.1).
- „an act of business ownership and business creation that empowers women economically, increases their economic strength, decision making capacity as well as position in society” (Law Insider, 2024, p.1).

The above-mentioned definitions emphasize the fact that the concept of women entrepreneurship puts women in the center of its process. Women are the main actors within this type of entrepreneurial process because they create and develop businesses. Consequently, a women-owned business represents “a business that is than 50 % owned by one or more women, whose management and control lie with one or more women, where a woman is a signatory of the business’s legal documents and financial accounts, and which is operated independently from businesses that are not owned by women” (International Standard Organization, 2021, p. 1). Achieving business success in a highly turbulent (Toma, 2005; Toma *et al*, 2015) and increasingly digitalized (Toma *et al*, 2018a) environment requires women entrepreneurs to design and implement clear strategies (Toma *et al*, 2016a; Toma *et al*, 2016b) and sound business models (Tohănean *et al*, 2018; Toma *et al*, 2019) which comprise various ingredients, such as strategic planning (Toma, 2008a) and thinking (Toma *et al*, 2013a; Toma *et al*, 2016c), strong leadership (Cornescu *et al*, 2004; Catană *et al*, 2020), agile management (Toma, 2023), lean management (Naruo *et al*, 2007; Marinescu *et al*, 2008), quality management (Toma, 2006; Toma *et al*, 2009), entrepreneurial (Grădinaru *et al*, 2017; Grădinaru *et al*, 2018) and creative (Toma *et al*, 2013b; Toma *et al*, 2018b) mindset, social responsibility (Toma *et al*, 2011; Imbrișcă *et al*, 2020) and corporate citizenship (Toma, 2008b; Marinescu *et al*, 2010), marketing mix (Toma, 2013c; Catană *et al*, 2021), Six Sigma (Toma, 2008c) and balanced scorecard (Toma *et al*, 2010).

The global progress of women entrepreneurship is measured through various indicators, such as the Mastercard Index of Women Entrepreneurs which comprises the following three components (Mastercard, 2024):

- women’s advancement outcomes,
- knowledge assets and financial access,
- entrepreneurial supporting conditions.

All in all, women entrepreneurship has represented one of the fastest rising topics in the business literature since the start of the 21st century (Gundry *et al*, 2002; de Bruin *et al*, 2006). Following this trend, the paper tries to identify some of its main characteristics in the fourth part.

3. Research methodology

To attain the purpose of the paper the author used a qualitative scientific research method. First, he obtained the needed information from various secondary data sources, such as books, reports and articles. Second, the author reviewed the literature. Third, he carefully analyzed the information. Then, the author wrote the paper.

4. Findings

Since its emergence, women entrepreneurship has expanded all over the world. Important advancements were recorded in the majority of the countries of the world. However, women in high income economies are better placed than others and United States, Switzerland and Canada are good examples (Table no. 1 and Table no. 2).

Table no. 1. Mastercard Index of Women Entrepreneurs 2020 global ranking

Ranking	Country	Score
1	Israel	74.7
2	United States of America	74.0
3	Switzerland	71.5
4	New Zealand	70.1
5	Poland	68.9
6	United Kingdom	68.7
7	Canada	68.6
8	Sweden	68.3
9	Australia	67.5
10	Spain	67.3

Source: (Mastercard Index of Women Entrepreneurs, 2020)

Table no. 2. Mastercard Index of Women Entrepreneurs 2021 global ranking

Ranking	Country	Score
1	United States of America	69.9
2	New Zealand	69.8
3	Canada	68.6
4	Australia	67.2
5	Switzerland	66.7
6	Taiwan	66.3
7	Germany	66.2
8	Israel	65.3
9	United Kingdom	64.9
10	Sweden	64.9

Source: (Mastercard Index of Women Entrepreneurs, 2022)

A comprehensive literature review allowed the author to better understand the concept of women entrepreneurship and to decipher some of its key characteristics. Starting from the above-mentioned definitions and based on the review of numerous studies, he concluded that:

- Women entrepreneurship has become a global phenomenon and, therefore, constituted a topic of interest for many people around the world.
- As society has recognized the high potential of women, governments and policy-makers worldwide have understood the importance of promoting and stimulating women entrepreneurship.
- The intensity of women entrepreneurship varies across the world.
- Women entrepreneurship contributes to economic development.
- In spite of the fact that gender bias still persists in various aspects of the business world, women entrepreneurship is continuously growing at a global scale.
- Women entrepreneurship places women entrepreneurs at its core.
- The gender gap makes more difficult for women to establish a business.

- Women entrepreneurship can bring new and innovative solutions to a plethora of problems.
- Women entrepreneurship is present in any industry and service of economy.
- In most cases, women entrepreneurship provides women the possibility of gaining their economic independence.
- As women are also involved in household activities, women entrepreneurship may lead to an imbalance between their personal and professional life.

5. Conclusions

Despite the existence of a gender bias, women entrepreneurship succeeded in becoming a topic of interest for both theoreticians and practitioners. From a theoretical point of view, the concept of women entrepreneurship has been and is still analyzed from various perspectives. This is why numerous studies and books were published worldwide on this topic. From a practical point of view, the emergence and development of women entrepreneurship represents a global phenomenon. In this respect, there are numerous initiatives and programs aiming at promoting and stimulating women entrepreneurship.

The paper contributes to the expansion of the scientific literature regarding women entrepreneurship. It analyses various definitions and identifies several main characteristics of women entrepreneurship. Further studies may broaden this research by emphasizing other important elements of women entrepreneurship.

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Section V

Finance and Accounting

Can Rent-Seeking Behavior and Corruption Impact the Economic Wealth of European Union Member States?

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Abstract

Corruption and rent-seeking are widespread issues affecting economies regardless of their European Union (EU) membership or development level. This study aims to empirically analyze how these behaviors influence the economic performance of EU member states using also governance quality indicators and a panel data regression model, thereby enhancing the understanding of the relationship between corruption, governance quality, and economic wealth within the EU. The period of study is from 2000 to 2019. The regression analysis indicates a negative relationship between higher levels of corruption and economic wealth across all examined countries, demonstrating that increased corruption leads to a decline in economic growth and prosperity. For all EU states, the governance quality variables do not appear to have an impact on economic wealth. Comprehensive reforms and a stronger anti-corruption effort in the public sector are urgently needed in developing countries to enhance accountability, transparency, and sustainable economic development.

Key words: economic wealth, rent-seeking, corruption, public choice

J.E.L. classification: H11

1. Introduction

Corruption and rent-seeking are ubiquitous phenomena found across various economies, regardless of their EU membership date or level of development. While these issues have been extensively explored in academic literature, their effects on the distribution of public financial resources and taxpayers' interests remain critical areas for further research, as the variability in these practices significantly impacts economic prosperity, market functionality, and the broader welfare and development of nations.

Corruption and rent-seeking behaviors, from a approach grounded in public choice theory, are indicative of systemic failures within the state, stemming from bureaucratic inefficiencies, systemic limitations, and inadequate transparency, while simultaneously reflecting the self-interested motivations of public representatives who exploit their positions to enhance their personal benefits. As a complex and multi-dimensional issue, corruption is often intertwined with rent-seeking and tax evasion, both of which contribute to adverse effects on societal progress and exacerbate inequalities within communities.

This study aims to provide an empirical analysis of how corruption and rent-seeking behaviors influence the economic prosperity of European Union member states, utilizing variables that reflect governance quality. The primary objective is to construct and implement a suitable panel data regression model to assess the effects of these detrimental behaviors on economic wealth, while taking governance quality and corruption perception index into account. This research seeks to deepen the understanding of the connections between corruption, governance quality and economic performance within the European Union by analyzing these dynamics.

2. Literature review

This study enriches the existing literature by providing a detailed analysis of the impact of corruption and rent-seeking on economic wealth, specifically emphasizing the value of assessing these issues in relation to governance quality. Public choice theory, which emerged more than five decades ago, has continually evolved and gained recognition, influencing both academic perspectives and societal attitudes toward political issues. Buchanan and Tullock (1962) argue that understanding the incentives and preferences of individuals is crucial for designing effective democratic institutions that align with the principles of social cooperation and public choice. A comparison with public opinions from the 1950s indicates increased skepticism among both academics and the public toward politicians and the effectiveness of political solutions to social issues (Dinca, 2006). The theory examines how public sector decision-makers, like private individuals, prioritize the maximization of their own utility, often acting in their self-interest. Individuals quickly learn to leverage any rights or powers they obtain, recognizing public resources and freedoms as avenues for wealth and control for those in possession of them (Buchanan, 1987).

According to Anechiarico and Jacobs (1994), corruption diminishes public trust in the overall welfare of society and challenges the legitimacy of political institutions. Furthermore, Aidt (2016) identifies two primary types of corruption: "helping hand" corruption, which arises when decision-making power is granted to a malicious or incompetent group, and "grabbing hand" corruption, which occurs when politicians endorse ineffective policies for personal gain, reflecting the tendency of individuals to prioritize their own interests over the common good.

From a public choice perspective, corruption is linked to a lack of transparency and excessive bureaucracy in public administration, which excludes citizen participation and adversely affects economic life, wealth, and growth due to the pursuit of individual interests. Corruption encompasses the misappropriation of public resources by officials, nepotism, embezzlement of funds, tax evasion, abuse of public positions for personal gain, neglect of social responsibilities, facilitation of transactions in exchange for bribes, and the acceptance of various benefits (Rasheed, 1993). Extensive research indicates that corruption has a substantial detrimental effect on economic growth and the efficiency of economic activities, significantly undermining private investments, reducing employment rates, and lowering income per capita (Bentzen, 2012; Shera, Dosti, and Grabova, 2014; Bayar et al., 2018; Sharma and Mitra, 2019).

Rent-seeking is an economic concept that describes the efforts of individuals or groups to obtain income without contributing to the production of goods and services, often by influencing public policy or exploiting advantages provided by government regulations. Gary Becker (1976) defines rent-seeking as activities aimed at gaining income based on legal advantages or regulatory benefits, which do not add economic value and distort optimal market behavior. Anne Krueger (1974) builds on this idea by stating that rent-seeking involves the use of resources to influence political decisions, enabling individuals to achieve income without producing goods or services. Consequently, rent-seeking undermines economic efficiency.

James M. Buchanan (1975) emphasizes that rent-seeking encompasses actions intended to restrict competition and influence political decisions to generate economic gains. Gordon Tullock (1967) further defines rent-seeking activities as those involving spending to obtain economic advantages through favorable regulations, which represents a form of uncompetitive behavior. William Nordhaus (2005) notes that these activities not only create inequities but also distort markets, replacing innovation and economic growth with unproductive activities. Overall, the concept of rent-seeking is consistently linked to negative effects on the economy, as it redirects resources toward unproductive activities and disrupts market equilibrium. In a previous study, Dinca et al. (2021) emphasized the necessity of effective governance reforms to mitigate corruption and enhance transparency, highlighting their importance for improving economic prosperity across EU member states, and advocating for further research to explore how these dynamics can be effectively addressed.

Public choice policies promote reforms in the state system and public financial policies to enhance economic efficiency and equity in public institutions by reducing social expenditures, curbing the influence of interest groups, and fostering meritocracy while tackling corruption.

3. Research methodology

This paper assesses the effects of corruption and rent-seeking behaviors on the economic prosperity of European Union nations from a public choice perspective. To achieve a comprehensive evaluation of how these behaviors impact economic wealth, a panel regression analysis encompassing all EU countries from 2000 to 2019 was conducted. Furthermore, informed by the findings of Anh et al. (2016), Sharma and Mitra (2019), and Montes and Luna (2020), the author has chosen to incorporate a set of governance quality indicators into the model, as they provide valuable insights into the dynamics of corruption and rent-seeking behaviors through the lens of public choice theory. Building upon the model developed by Shera, Dosti, and Grabova (2014), the following variables are detailed in Table no.1 below.

Table no. 1 The variables

Dependent variable	Unit	Abbreviation	Source	
Gross domestic product growth	Annual %	gdpgrowth	World Bank	
Independent variables	Unit	Abbreviation	Expected influence	Source
Gross fixed capital formation	Annual % growth	capform	+	World Bank
Corruption perception index (rescaled)	Score (0-10)	cpi	-	Transparency Int
Crude rate of total population change	%	popchange	+	Eurostat
Government expenditure	% of GDP	govexp	+	Eurostat
School enrollment, secondary	% net	edusek	+	World Bank
Total fixed assets	% of GDP	investm	+	Eurostat
Trade openness	% of GDP	trade	+	World Bank
Inflation	Annual %	inf	-	World Bank
Voice and accountability	Score (-2,5;2,5)	voice	+	World Bank Governance Indicators Database
Government effectiveness	Score (-2,5;2,5)	goveff	+	World Bank Governance Indicators Database
Rule of law	Score (-2,5;2,5)	rlaw	+	World Bank Governance Indicators Database
Control of corruption	Score (-2,5;2,5)	contrcorr	+	World Bank Governance Indicators Database

Source: Author' processings

For this analysis, the regression equation is as follows:

$$gdpgrowth_{it} = \alpha + \beta_1 capform_{it} + \beta_2 cpi_{it} + \beta_3 popchange_{it} + \beta_4 govexp_{it} + \beta_5 edusek_{it} + \beta_6 investm_{it} + \beta_7 trade_{it} + \beta_8 inf_{it} + \beta_9 contrcorr_{it} + \beta_{10} voice_{it} + \beta_{11} rlaw_{it} + \beta_{12} goveff_{it} + \mu_i + \varepsilon_{it}$$

where the dependent variable is represented by $gdpgrowth_{it}$, followed by the independent variables $capform_{it}$, cpi_{it} , $popchange_{it}$, $govexp_{it}$, $edusek_{it}$, $investm_{it}$, $trade_{it}$, inf_{it} , $voice_{it}$, $goveff_{it}$, $rlaw_{it}$, $contrcorr_{it}$, and μ_i , which captures the constant effect and particularity of each European Union state $i=1, 2, \dots, 28$, at the time $t=1, 2, \dots, T$, where T is the observed time in the model and ε_{it} is the error term that is correlated with the independent variables.

The model uses the Corruption Perception Index as the main independent variable to assess perceived corruption in the public sector across EU member states, rescaling scores to reflect that higher values indicate greater perceived corruption. It is anticipated that increased corruption levels will negatively impact economic development, measured in this study as GDP growth.

Gross fixed capital formation (investment) is a control variable in the models by Shera, Dosti, Grabova (2014), and Al Qudah, Zouaoui and Aboelsoud (2020), representing the total investment in fixed capital assets within an economy, including land improvements, machinery purchases, and construction of infrastructure such as schools and hospitals.

In the model total general government expenditure and total fixed assets are key control variables, with expenditure reflecting overall governmental expenses and net acquisitions as a percentage of GDP. Research suggests that increased government spending and growing fixed assets positively impact GDP and economic growth. Additionally, the crude rate of total population change is included to assess how population growth can enhance consumption and labor supply, thereby increasing demand and production. Secondary school enrollment is also considered significant, as it fosters human development and lifelong learning, aligning with findings from Mauro (1997) and Ali and Isse (2003). Other control variables considered in this research are the level of import and exports (% of GDP), as well as the level of inflation. Trade reflects the total value of goods and services exchanged internationally and indicates a country's openness to global markets. It is expected that higher trade levels will boost production and contribute positively to overall economic growth. Consistent with theories on economic growth determinants, these variables are anticipated to have a positive impact on GDP growth, as shown in Shera, Dosti and Grabova (2014).

To examine the connection between democracy and economic wealth in relation to public choice theory, four governance quality indicators, namely voice and accountability, government effectiveness, rule of law, and control of corruption were assessed, all scored from -2.5 to +2.5, where higher scores signify improved government performance and a positive effect on economic wealth. Montes and Luna (2020) highlight voice and accountability as indicators of media freedom and individual expression. The rule of law measures compliance with laws, property rights, and judicial quality while considering crime risks. Control of corruption reflects the extent of corruption in public offices and its impact on self-interest and special interest groups, as per World Bank methodology. Government effectiveness assesses the quality of public services and policies and the commitment to governance objectives.

The effects of all these variables on the dependent variable are detailed in the empirical findings section, while Table no. 2 presents a summary of the key descriptive statistics for the variables involved in the analysis.

Table no. 2 Descriptive Statistics for total EU28 sample

	N	Minimum	Maximum	Mean	Std. Deviation
GDP growth (annual %)	560	-14.8386	25.1625	2.5225	3.4272
Gross fixed capital formation (annual % growth)	559	-38.9026	94.1904	3.1939	10.9420
Corruption Perception Index (0-10)	553	2.6000	10.0000	6.3320	1.7800
Crude rate of total population change (%)	560	-35.0000	41.7000	2.5729	8.5832
Total general government expenditure (% of GDP)	560	24.5000	65.1000	44.6341	6.4628
School enrollment, secondary (% net)	441	79.0943	99.8349	91.0396	4.2962
Total fixed assets (gross) (% of GDP)	560	10.1000	45.6000	22.1277	4.1163
Trade (% of GDP)	560	45.4188	408.3620	116.9484	64.9576
Inflation (annual %)	560	-4.4781	45.6666	2.5449	3.3133
Control of corruption (-2,5; 2,5)	532	-.4913	2.4700	1.0336	.7919
Voice and Accountability (-2,5; 2,5)	532	.2201	1.8010	1.1206	.3396

Rule of law (-2,5; 2,5)	532	-.2601	2.1003	1.1208	.6150
Government Effectiveness (-2,5; 2,5)	532	-.3732	2.3540	1.1358	.6041

Source: Author' processings using Stata

In this model, descriptive statistics reveal that trade has the highest deviation from the average, reaching 64.96% of GDP, indicating the openness of European countries to import and export activities. Luxembourg tops the list with the highest trade value, recording 408.36% of GDP in 2015, while Malta follows, with trade activities approximately three times its GDP in 2012. Conversely, countries such as France, Greece, the United Kingdom, Spain, and Romania engage in the least import and export activities, with Italy having the lowest trade value at 45.42% of GDP in 2009.

Gross fixed capital formation, with an annual growth of 10.94%, shows another significant standard deviation, reflecting strong asset acquisitions by governments, businesses and households. A high level of this variable is a positive indicator for future economic growth, highlighted by Ireland's peak value in 2019. Investment rate differences among countries often correlate with economic development levels, as seen in Lithuania's 40% reduction in 2009 during the economic crisis, a trend also observed in Estonia, Romania, and Spain.

Voice and accountability, with the lowest standard deviation of 0.34 indicates strong citizen participation and freedom in Denmark, Finland, Luxembourg, the Netherlands, and Sweden, while Romania, Bulgaria, Croatia, and Greece exhibit limited public engagement in elections and media corruption issues.

Reduced levels of standard deviation are observed in government effectiveness, rule of law, and control of corruption across the EU countries, with the highest scores in Finland, Denmark, and Sweden, while Bulgaria, Croatia, Greece, and Romania show the lowest levels.

The corruption index demonstrates a low standard deviation (6.33), indicating data clustering around the mean, with Finland having the highest score in 2000 as the least corrupt EU country, followed by Sweden and Denmark, while Romania, Bulgaria, Slovakia, and Greece exhibit the lowest scores, reflecting higher corruption levels and consequently slower economic development.

The GDP growth rate shows a significant standard deviation, indicating data variability influenced by economic crises and investment levels, with Latvia and Lithuania experiencing negative growth rates in 2009 due to the 2008 crisis-Lithuania recording a low of -14.84%-while periods of economic growth are reflected in the maximum rates achieved by Ireland in 2015, Latvia in 2006, and Slovakia and Romania in 2007 and 2004, respectively.\

From 2000 to 2019, the average secondary school enrollment rate in the EU was 91.03%, with Sweden leading at 99.83%. While secondary education fosters lifelong learning, enrollment is lower in Greece and Portugal, around 79%. Many EU countries, such as Romania and Bulgaria, face population declines due to migration and natural causes, with Bulgaria experiencing a significant drop of 35 per 1,000 people in 2001. Conversely, more developed countries like Luxembourg, Ireland, and Malta have seen population growth, particularly Malta, which recorded an increase of 41.7 per 1,000 people in 2019.

Total government expenditures and fixed assets have standard deviations below 7%, indicating data clustering. Estonia and Ireland had high investment levels in 2019, approaching half of their GDP, while Greece, Cyprus, and Bulgaria recorded low fixed asset values, with Greece at just 10% of GDP. From 2000 to 2019, Malta, Romania, Lithuania, Estonia, and Bulgaria consistently reported government expenditures below the EU average of 44.63%, whereas Sweden, France, and Austria exceeded this average, with expenditures around half of their GDP.

4. Findings

The research implements three methods for static panel data regressions inspired by Shera, Dosti, and Grabova (2014): Pooled Ordinary Least Squares (OLS), Fixed Effects Model (FEM), and Random Effects Model (REM). Pooled OLS treats all countries as homogeneous, which can be a disadvantage if it doesn't account for correlations between individual elements and independent variables. FEM treats explanatory variables as non-random and is useful for assessing the impact of variables that change annually, helping estimate the net effect by removing time-independent effects.

The key difference between FEM and REM is their handling of individual effects: if these effects are random and uncorrelated with the independent variables, REM is appropriate; if there's a correlation, FEM is more suitable. Several tests can be used to choose between these three methods. The F-test, based on the Lagrange Multiplier (LM), is used to decide between Pooled OLS and FEM, while the Hausman test helps select between REM and FEM. The Breusch-Pagan test may be implemented to the FEM to detect heteroscedasticity, indicating whether the variance of residuals is constant across observations.

Table no. 3 Coefficients and p-values showing statistical significance of the considered variables

Dependent variable: GDP growth annual%								
Independent Variable	Pooled OLS		REM		FEM		PCSE	
	Coefficient (Std. err.)	P-value	Coefficient (Std. err.)	P-value	Coefficient (Std. err.)	P-value	Coefficient (Std. err.)	P-value
Gross fixed capital formation (annual % growth)	0.2246 (0.0115)	0.0000	0.2228 (0.0115)	0.0000	0.2149 (0.0122)	0.0000	0.2246 (0.0201)	0.000
Corruption Perception Index (0-1)	-0.3715 (0.2730)	0.1740	-0.3810 (0.2746)	0.1650	-0.4653 (0.2946)	0.1150	-0.3715 (0.1791)	0.038
Crude rate of total population change (%)	-0.0002 (0.0164)	0.9910	0.0023 (0.0178)	0.8970	0.0107 (0.0261)	0.6820	-0.0002 (0.0360)	0.996
Total general government expenditure (% of GDP)	-0.1332 (0.0205)	0.0000	-0.1511 (0.0230)	0.0000	-0.3130 (0.0430)	0.0000	-0.1332 (0.0240)	0.0000
School enrollment, secondary (% net)	-0.0261 (0.0282)	0.3560	-0.0328 (0.0310)	0.2900	-0.0580 (0.0493)	0.2400	-0.0261 (0.0516)	0.613
Total fixed assets (gross) (% of GDP)	0.0266 (0.0335)	0.4290	0.0125 (0.0361)	0.7290	-0.1211 (0.0524)	0.0210	0.0266 (0.0514)	0.605
Trade (% of GDP)	0.0020 (0.0020)	0.3150	0.0013 (0.0023)	0.5790	-0.0064 (0.0071)	0.3680	0.0020 (0.0018)	0.254
Inflation (annual %)	-0.0121 (0.0580)	0.8350	-0.0149 (0.0585)	0.7990	-0.0053 (0.0627)	0.9330	-0.0121 (0.0921)	0.895
Control of corruption (-2,5; 2,5)	1.0224 (0.7681)	0.1840	1.1530 (0.7815)	0.1400	1.9413 (0.9383)	0.0390	1.0223 (0.8072)	0.205
Voice and Accountability (-2,5; 2,5)	0.8166 (0.9694)	0.4000	0.7193 (1.0400)	0.4890	0.1879 (1.4034)	0.8940	0.8166 (1.2728)	0.521
Rule of law (-2,5; 2,5)	-1.1124 (0.7213)	0.1240	-1.1896 (0.7822)	0.1280	-0.4454 (1.1727)	0.7040	-1.1124 (0.7064)	0.115
Government Effectiveness (-2,5; 2,5)	0.6167 (0.6232)	0.3230	0.6576 (0.6509)	0.3120	-0.0622 (0.8283)	0.9400	0.6167 (0.7504)	0.411
Constant	10.2704 (0.6232)	0.0010	12.1563 (3.5149)	0.0010	25.8662 (5.8523)	0.0000	10.2704 (5.1974)	0.048
Obs.	414		414		414		414	
R-squared	0.6250		0.6241		0.5618		0.6250	
Prob>F	0.0000		0.0000		0.0000		0.0000	

Source: Author's processings using Stata

Applying the Pooled OLS regression model, it is observed (Table no. 3) that only gross fixed capital formation and total general government expenditure are significant predictors in this analysis; however, this is based on a simplified OLS model. The adjusted R-squared value indicates that the estimated model explains 62.5% of the variance in annual GDP growth. Specifically, a one-unit increase in government expenditure is associated with a reduction in GDP growth of 0.133%, while a one-unit increase in gross fixed capital formation is associated with a 0.22% increase in GDP growth (statistically significant at $p < 0.001$). This confirms that investment is a key driver of economic growth.

Table no. 3 also presents the results from the evaluation of the Random Effects Method (REM), highlighting a negative impact of corruption on economic growth, with only capital formation and government expenses identified as statistically significant within the model. The adjusted R-squared value reveals that the model accounts for 62.41% of the variance in GDP growth. Specifically, a one-unit increase in government expenses is associated with a 0.151% decrease in GDP growth, whereas a one-unit increase in capital formation correlates with a 0.223% increase in GDP growth.

Using Fixed Effects Method for the EU28 sample, the analysis highlights significant variables influencing economic growth, including gross fixed capital formation, government expenditures, total fixed assets, and control of corruption, although only three display expected positive relationships, while investment unexpectedly shows a negative correlation. The adjusted R-squared value indicates that the model accounts for 56.18% of the variance in GDP growth. Furthermore, a one-unit increase in total fixed capital formation and control of corruption leads to annual GDP growth increases of 0.215% and 1.94%, respectively. In contrast, a one-unit rise in government expenditures results in a 0.313% decrease in GDP growth annually, while a corresponding increase in investments correlates with a 0.121% reduction in GDP growth. This underscores the complex dynamics between these variables and economic growth within the EU28 context. All three evaluations yield an F-statistic value of less than 0.05, allowing us to reject the hypothesis that the estimated model is significantly invalid and affirming the validity of the model.

Table no. 4 Heteroskedasticity LR Test

Null hypothesis: Residuals are homoscedastic		
	Value	Probability
Likelihood ratio	396.98	0.0000

Source: Author' processings using Stata

The primary concern with Pooled OLS regression is its assumption that diverse EU countries are similar, disregarding their distinct economic and cultural differences. This highlights the need for a model that incorporates these unique characteristics, supporting the recommendation for a panel data regression. Additionally, the heteroskedasticity LR test produced a p-value of 0.0000 which is less than 0.05, further favoring the REM over Pooled OLS. (see Table no 4).

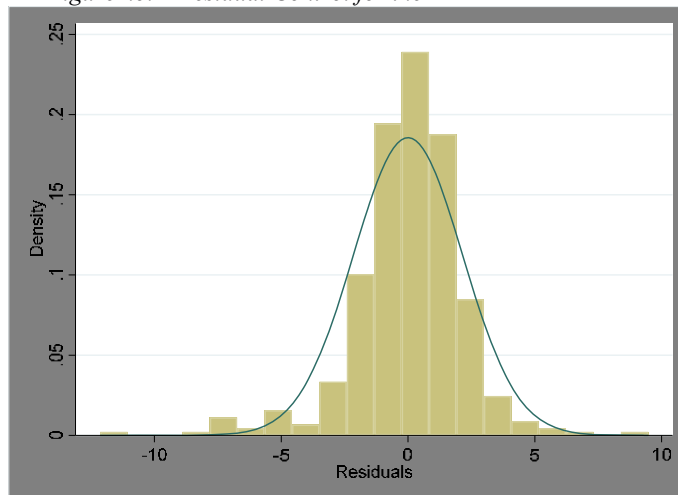
Table no. 5 Hausman Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Probability
Cross-section random	31.32	12	0.0018

Source: Author' processings using Stata

The Hausman test is a statistical method utilized in econometrics to decide between the Fixed Effects Model and the Random Effects Model. Model in panel data analysis. According to Greene (2008), the results presented in Table no.5 demonstrate a Chi-square statistic with a probability value of 0.0018- significantly lower than 0.01- which leads author to reject the null hypothesis in favor of the Fixed Effects Model as the more efficient choice over the Random Effects Model.

Figure no. 1 Residual Control for the FEM



Source: Author' processings using Stata

The results from the Normality test for the residuals (Table no.6) indicate that the variables do not follow a normal distribution, as evidenced by a probability value of 0.0000, which is significantly less than the conventional significance level of 0.01. This finding suggests that the distribution of the residuals deviates substantially from normality, indicating potential issues with the assumptions underlying the regression model. The normality in the residuals undermines the validity of statistical inferences from the model, necessitating further analyses to explore the characteristics of the residuals, identify potential specification errors, and implement adjustments to enhance the robustness and credibility of the analysis (Figure no.1).

Table no. 6 Skewness and kurtosis tests for normality

Variable	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
Residuals	0.0000	0.0000	71.18	0.0000

Source: Author' processings using Stata

To assess cross-sectional dependency among the residuals in the dataset, the Pesaran CD test was conducted, evaluating whether the residuals are correlated across countries. The null hypothesis states that there is no correlation among the residuals. The results showed a Pesaran CD statistic with a probability value of 0.0000, which is significantly lower than the 0.01 threshold, leading the author to reject the null hypothesis and confirm the presence of cross-sectional dependency in the model. This correlation indicates that the errors across countries are not independent, underscoring the need to address this issue in the analysis to avoid biased estimates and invalid statistical inferences.

Taking this into consideration, Panel-Corrected Standard Errors (PCSE) is a valuable approach for addressing issues of non-normality and cross-sectional dependence in residuals. This method adjusts standard errors for both heteroskedasticity and correlation across cross-sectional units, providing more reliable coefficient estimates. Utilizing Panel-Corrected Standard Errors (PCSE) enhances the validity of hypothesis tests and confidence intervals, thereby reinforcing the robustness and credibility of the findings in panel data analyses, particularly for the EU28 sample, where the number of countries exceeds the number of time periods in the dataset.

The PCSE regression analysis demonstrates, as expected, a statistically significant negative correlation between both corruption perception and government expenditure, and economic growth (GDP growth). The model indicates that increased perceived corruption and higher government spending are associated with reduced economic growth. Higher levels of perceived corruption significantly decrease economic growth, with a one-unit increase in the corruption perception index associated with a 0.37% annual decrease in economic output. This suggests that EU member states experiencing slower GDP growth are disproportionately affected by corruption. Conversely, gross fixed capital formation exhibits a positive relationship with economic development. This model shows moderate explanatory power, accounting for approximately 62.5% of the variance in GDP growth. The model's high overall statistical significance (indicated by a very low p-value) confirms that at least one independent variable significantly influences GDP growth.

Nevertheless, the majority of the remaining independent variables show no statistically significant relationship with economic growth within this particular model specification. Further research, potentially incorporating additional variables or utilizing alternative econometric methods, may be required to gain a more comprehensive understanding of the determinants of economic growth.

This study of the EU28 found that measures of governance quality failed to show a statistically significant positive impact on economic growth, contrary to the predictions of public choice theory. While public choice theory posits that improved governance—characterized by reduced rent-seeking behavior, minimized influence of personal interests, and lessened political pressure on state administration—should foster economic prosperity, this analysis did not support that hypothesis. The lack of a significant positive relationship suggests that other factors may be more influential in determining economic growth within the EU28 or that the measured governance indicators may not fully capture the relevant aspects of governance quality impacting economic outcomes. Further investigation is warranted to explore potential mediating variables or alternative theoretical frameworks.

5. Conclusions

Corruption in the European Union negatively impacts society and economic wealth, with varying effects based on each country's level of development, supporting public choice theory's emphasis on the adverse effects of self-interest overriding social welfare. It is a well-documented issue affecting both developed and developing countries worldwide. The results section of the study reveals a negative correlation between corruption levels and economic wealth across all EU member states, with a notable impact in countries experiencing lower GDP growth. This suggests that as corruption increases, economic wealth—measured by GDP growth—tends to decrease. The correlation is particularly pronounced in newer EU member states, which generally have lower GDP levels and are more severely affected by corruption compared to older member states. Overall, this relationship indicates that higher corruption levels can restrict economic development and prosperity within these nations.

This research contributes to the existing literature by offering a new perspective that encourages policymakers to implement measures that foster sustainable development for all stakeholders, particularly the populations they represent. The topic of corruption and its multifaceted effects is too vast to be thoroughly examined within the confines of this paper. Issues such as systemic corruption, its interaction with governance structures, and the socioeconomic implications require extensive exploration.

Measures of governance quality in this study do not show a statistically significant positive effect on economic growth, challenging public choice theory, which posits that improved governance should lead to greater economic prosperity by mitigating rent-seeking behavior and political pressures. Additional research is necessary to examine potential mediating variables or to consider alternative theoretical frameworks because of the limitations of the study.

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Considerations Related To The Application Of Deep Learning And Neural Networks In Finance And Banking. A Bibliometric Approach

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Abstract

The aim of this paper is to examine the impact and applications of Deep Learning (DL) and Neural Networks (NN) in financial markets and especially on banking markets, using a bibliometric analysis based on 970 articles published between 2015-2024. The study highlights key trends, collaboration networks and influential contributions using data extracted from the Web of Science database and analyzed with VOSviewer software. Findings illustrate the widespread integration of those two AI applications in financial approaches such as credit evaluation, stock market forecasting and risk modeling. The study highlights the prominence of areas such as computer science and business economics while pointing out the need for hybrid models and explainable AI, essential for meeting regulatory compliance. Additionally, it emphasizes the interdisciplinary nature of this field, connecting AI with big data and financial systems.

Key words: deep learning, neural networks, banking, bibliometric analysis, VOSviewer

J.E.L. classification: G10, G20, G17, G45

1. Introduction

Due to the rapid advancement of artificial intelligence technologies, financial markets, including the banking sector were profoundly reshaped with the use of diverse techniques such as neural networks and deep learning taking an important role in solving complex challenges in the financial industry. This paper carries out a bibliometric analysis to explore the impact and trend of these innovations. The analysis aims to consolidate current insights, identify dominant patterns and highlight promising directions for future research on AI application in finance.

This study reviewed the neural networks (NN) and deep learning (DL) literature in the finance field. Using a bibliometric approach, we collected 970 articles published in a 10-year period between 2015-2024 from articles indexed in Web of Science database.

This research focuses on the essential role of artificial intelligence, particularly neural networks and deep learning in shaping the future of financial markets broadly, with a particular emphasis on the banking sector. The main framework of this paper focuses on exploring how neural networks and deep learning have been used in the financial sector, the extent of their influence, and the direction that future research in this area is taking.

The article begins with a literature review which provides an overview of the existing research on neural networks and deep learning in financial markets. Methodology presents the bibliometric analysis methods, including data collection and analysis approaches using VOSviewer software. In the end of the paper, the Findings section presents the results of the analysis, highlighting key trends, influential publications and collaboration networks between authors. Finally, the study concludes with reflections on the impact of these findings for future research in the financial industry, especially in banking industry.

2. Literature review

The studies on neural networks and deep learning in financial markets is vast and comprehensive. Jiayu et al. (2020) state in their research the fact that neural networks, particularly deep learning models such as Long Short-Term Memory (LSTM) networks, have been widely applied for stock price prediction and financial time series forecasting due to their ability to capture complex nonlinear relationships in data.

Other studies have illustrated that the use of neural networks could substantially enhance financial distress prediction achieving superior outcomes compared to traditional methods like logistic regression (Zizi et al., 2021). This ability is essential for banking entities aiming to reduce risks related to loan default and insolvency. (Zizi et al., 2021; Bracke et al., 2019).

There are also papers that focus on analyzing the impact of convolutional neural networks on stock market prediction, using various datasets beyond just historical prices, including information from news articles and social media sentiment analysis. (Hoseinzade and Haratizadeh, 2019; Matsubara et al., 2018).

Huang et al. (2020) stated that in finance and banking field, various deep learning models offer remarkable performance depending on the context:

- Neural Networks (NN) are ideal for processing cross-sectional data used in exchange rate forecasting, price estimation and macroeconomic analysis;
- Recurrent Neural Networks (RNN) and short-term memory (LSTM) are more efficient for serial data specific to stock market predictions;
- Reinforcement Learning (RL) proves optimal for stock trading scenarios involving autonomous decision-making and the self-learning process;
- Convolutional Neural Networks (CNN) are excellent at handling data with multicollinearity, being suitable for complex and multivariate environments in the financial and banking sphere.

Predictive modeling implying neural networks has emerged as a fundamental aspect of adopting artificial intelligence in the financial sector. For financial predictions, there are architectures such as deep learning and recurrent neural networks (RNNs) which are widely employed for financial predictions due to their potential to identify complex, non-linear relationships in large datasets. (Strielkowski et al., 2023). These models have been applied across diverse economic forecasting purposes, such as predicting risk assessment, stock prices and credit scoring.

Important studies have indicated that neural networks exceed classical methods in terms of forecasting precision and resilience (Nazareth and Reddy, 2023). For instance, Razak et al. (2023) shown that neural networks significantly improve the precision of credit rating evaluations, thereby contributing to enhanced risk management strategies within financial institutions.

3. Research methodology

For this study we adopt a bibliometric methodology that involves the use of quantitative approach to examine scientific literature by focusing on its external features. It employs statistical and mathematical methods to interpret the research landscape, identify trends and understand the attributes of specific academic fields.

In contrast to traditional systematic literature reviews, a bibliometric analysis has the capability to provide insights across disciplines marked by substantial volumes of citation metrics and bibliographic data. This method excels in handling fields where large quantities of such information are present. In essence, the bibliometric analysis provides a structured and data-driven way to explore the evolution, current state and future trajectory of deep learning and neural networks in financial markets. It highlights how these advanced artificial intelligence applications have reshaped the field and identifies opportunities for further exploration.

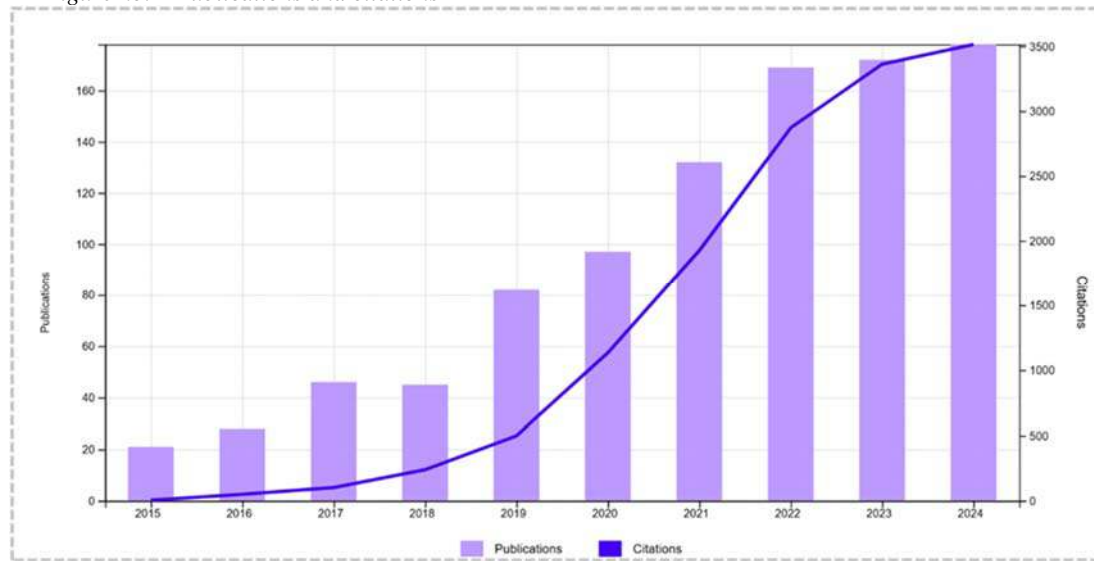
Web of Science database was the source for data collection in this material. Birkle et al. states that Web of Science (WoS) is the world's oldest, most widely used and authoritative database of research publications and citations. We selected this resource because it offers an extensive collection of academic publications, enabling us to access a wide and pertinent assortment of studies on the application of neural networks and deep learning within financial markets. Using the

Web of Science database, we compiled a substantial dataset totaling 970 articles published between 2015 and 2024, which will form the framework of our bibliometric analysis. Focusing on the last decade, the research aims to emphasize recent trends and methodologies that have appeared in financial markets

Our methodological approach implied collecting relevant data from the Web of Science database, including article titles, author identities, abstracts, key terms and citation data. This gathered information was then imported into the VOSviewer software to conduct various analyses, which are discussed in the following section.

To guarantee the inclusion of relevant publications, the data selection process implied the use of specific filters. In the analysis, only publications in English were taken into consideration given that English is the main language used in scientific communication and in this way this criterion ensures access to a large range of works while maintaining consistency in the interpretation of basic concepts and terminology. In addition, in order to filter the search and to conduct our study at the crossroad of financial markets and artificial intelligence, we use specific keywords such as financial markets* deep learning* or financial markets* neural networks*.

Figure no. 1 Publications and citations



Source: Graph exported from Web of Science

During the analyzed period, a total of 970 publications were searched from Web of Science. The total sum of times cited is 13,753 with the average citation per publication of 14.18 times.

Figure 1 illustrates a clear upward trend in both volume of publications and the number of citations from 2015 to 2024. This evolution reveals the growing relevance and interest in this research field over time and highlights the way AI techniques like deep learning and neural networks has gained relevance in financial markets, underscoring its value in both academic research and practical fields.

The sustained growth in publications involves continuous engagement and productivity in the field, while the significant boost in citations signals the broader acceptance of its importance and influence. This frame emphasizes the evolving and influential nature of the field, driving advancements in knowledge and innovation.

The continuous increase in the number of publications is closely linked to the rapid amplification of citations. As more and more papers appear, they expand the existing knowledge base, which leads to an increase in references and citations in related studies.

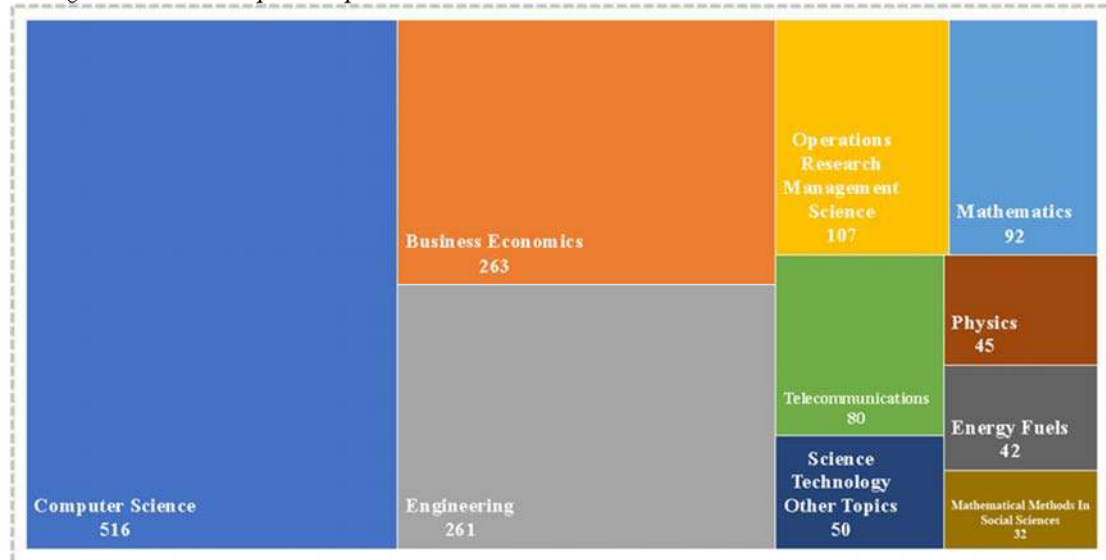
In addition, the significant jump in citations, observed especially after 2018, may suggest that previous works have reached a level of maturity and become important reference points, with the increasing interest and dynamism in this field.

A strong relationship between the continuous increase in the number of publications and the rapid expansion of citations highlights how a larger volume of works supports the development of a broader base for future studies.

4. Findings

Starting from the analysis of publications and citations, which highlighted a constant evolution of scientific production and a rapid amplification of academic references, the investigation of the tree map with the spread of publications in various areas brings a detailed perspective on the structure of the research field.

Figure no. 2 Tree map with top 10 research areas



Source: Author contribution based on data extracted from Web of Science

The provided tree map visualizes the top 10 research areas from a dataset of 970 articles that focus on the application of deep learning and neural networks in financial markets. The chart highlights the distribution of publications across different fields, emphasizing the multidisciplinary nature of this research area.

The largest segment in the tree map is Computer Science with 516 publications, reflecting the majority of the given dataset. This dominance shows that research in deep learning and neural networks is strongly embedded in the field of computer science. This reflects the emphasis on technical and computational expertise necessary for designing AI algorithms and systems tailored to financial use cases. Significant developments in this field encompass neural network architectures, deep learning frameworks, algorithm optimization and the handling of large-scale datasets.

Business Economics accounts for 263 publications, this being the second-largest research area. This significant proportion underscores the practical use of neural networks and deep learning in areas such as investment planning, analyzing market dynamics and risk mitigation. It illustrates the integration of artificial intelligence into financial models and economic frameworks to tackle real-world issues effectively.

Engineering follows closely with 261 publications, demonstrating its role in supporting the technological infrastructure for artificial intelligence in financial industry. This field is likely centered on enhancing computational efficiency, optimizing hardware and designing systems, all of which are essential for applying deep learning models in areas such as big data analytics, high-frequency trading and cloud-driven financial platforms.

Other segments, smaller than previous, such as Operations Research and Management Science (107 publications), Mathematics (92 publications), Telecommunications (80 publications), Science Technology Other Topics (50 publications), Physics (45 publications), Energy Fuels (42 publications) and Mathematical Methods in Social Sciences (32 publications) reflect the variety of interdisciplinary applications.

This distribution highlights the significant influence and promise of AI-powered methods in shaping the landscape of financial systems.

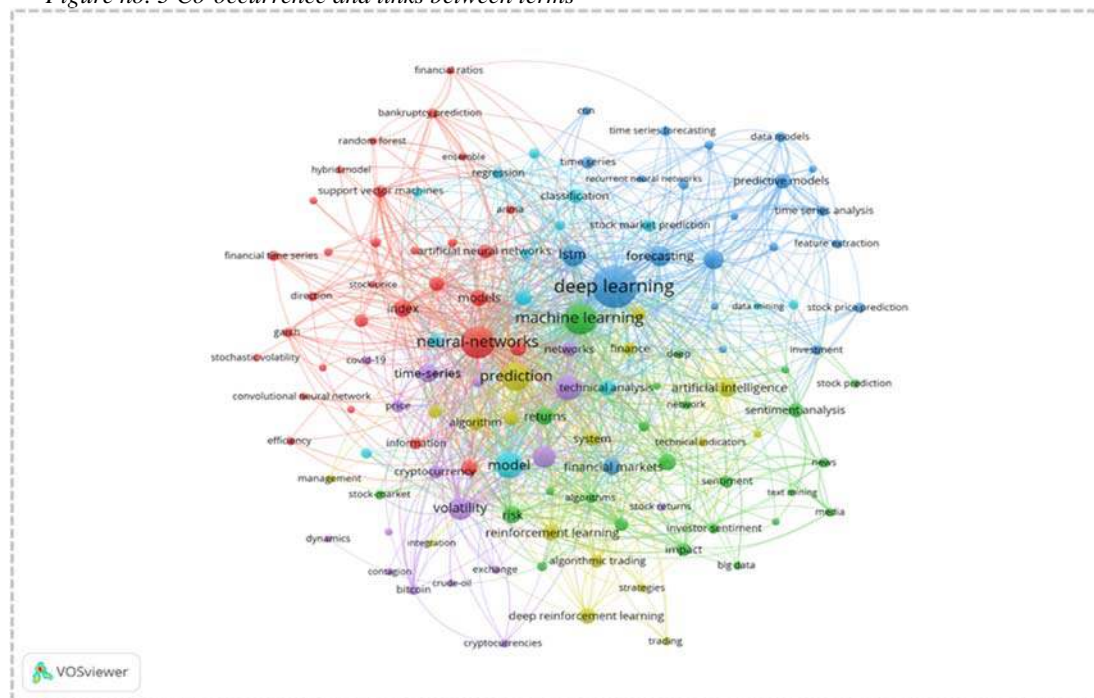
Moving forward, the paper focuses on the detailed exploration of bibliometric networks, including the co-occurrence network map, co-citation network and co-authorship network for countries. Building on the findings from the prior analysis, this section aims to deepen the understanding of how key terms, international collaborations and influential works shape or transform the academic framework in the implication of deep learning and neural networks in financial markets.

The chart (Figure 3) illustrates a co-occurrence network map of keywords drawn from the analyzed publications, created with the help of VOSviewer. This map reflects the connections between frequently appearing keywords in the dataset, where the nodes symbolize the keywords, and the links represent their simultaneous presence within the same publication.

The co-occurrence map generated with VOSviewer provides valuable insights into the interconnections and emerging research patterns related to the use of deep learning and neural networks in financial markets.

From the co-occurrence analysis, 3486 keywords were extracted, of which 124 keywords met the threshold of a minimum of 10 occurrences. These keywords were grouped into 6 clusters, which indicate major thematic areas of research, their interconnections and prevailing trends.

Figure no. 3 Co-occurrence and links between terms



Source: Author contribution using VOSviewer, based on data extracted from Web of Science

The analysis identified 124 frequently occurring keywords, with the most relevant being *deep learning*, *neural networks* and *machine learning*. Among these, deep learning demonstrated the highest total link strength (842) and occurrence frequency (257), positioning it as the central theme of research. This dominance reflects the widespread adoption of deep learning techniques for solving complex problems in financial markets, such as predicting stock prices, evaluating credit risks and analyzing financial time-series data.

Similarly, *neural networks*, appearing in two variations, *neural networks* and *neural-networks*, further underscore their essential position in financial research. The combined influence of these terms illustrates the critical role of AI-driven techniques in modern financial analysis and modeling.

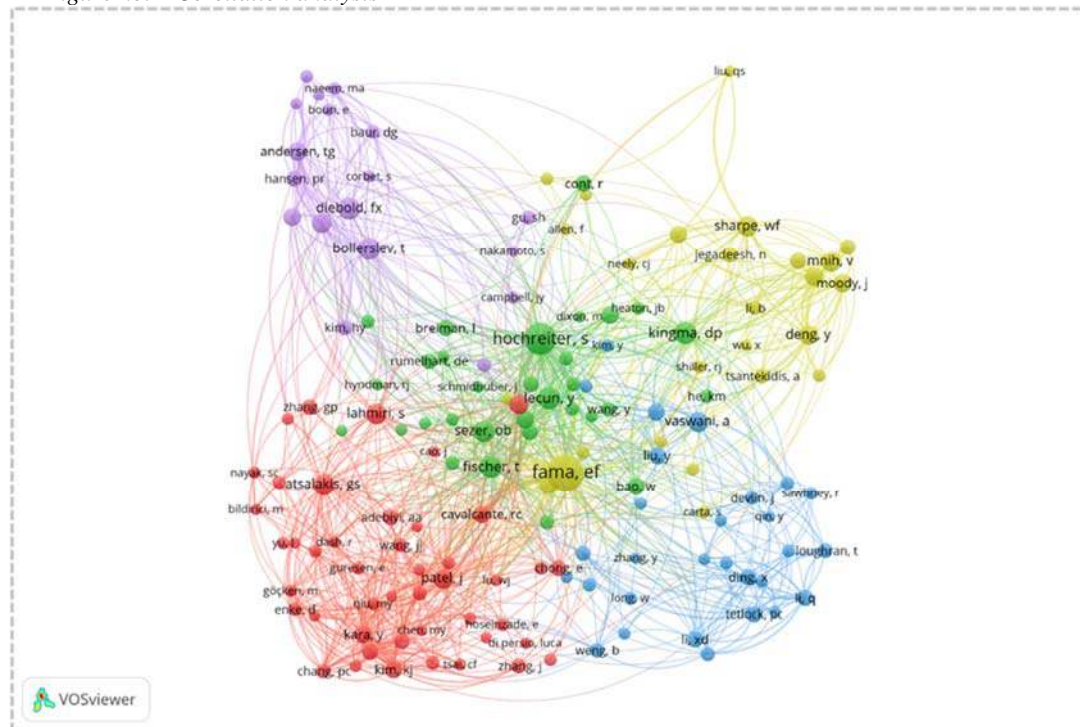
The clustering of keywords into six groups highlights distinct but interconnected themes. At the core of these connections is deep learning (Cluster 3) which shows strong associations with keywords like machine learning (Cluster 2) and prediction (Cluster 4). This relationship demonstrates that machine learning methods are frequently used to build deep learning models, particularly for predictive purposes in financial research.

Prediction emerged as another critical theme (Cluster 4), with strong connections to other keywords. This finding underscores the importance of forecasting in financial studies, including predicting market trends, volatility analysis and risks assessment. Additionally, the concept of a model (Cluster 6), which appears frequently (103 occurrences) and have a notable link strength of 455 facilitates the connection between theoretical deep learning architectures and practical financial applications such as risk modeling and algorithmic trading.

The analysis confirms that the core focus of research is on the application of AI, neural networks and deep learning for prediction-related tasks. Keywords such as algorithmic trading, financial time-series analysis and technical indicators suggest the broad use of AI in processing financial data, improving decision-making processes and forecasting market dynamics. These applications are essential for tasks such as stock price prediction, credit risk assessment and sentiment analysis.

Moreover, the relationships between keywords such as volatility, returns and financial markets suggest a wider investigation into how AI can be involved to address financial uncertainty and enhance investment strategies.

Figure no. 4 Co-citation analysis

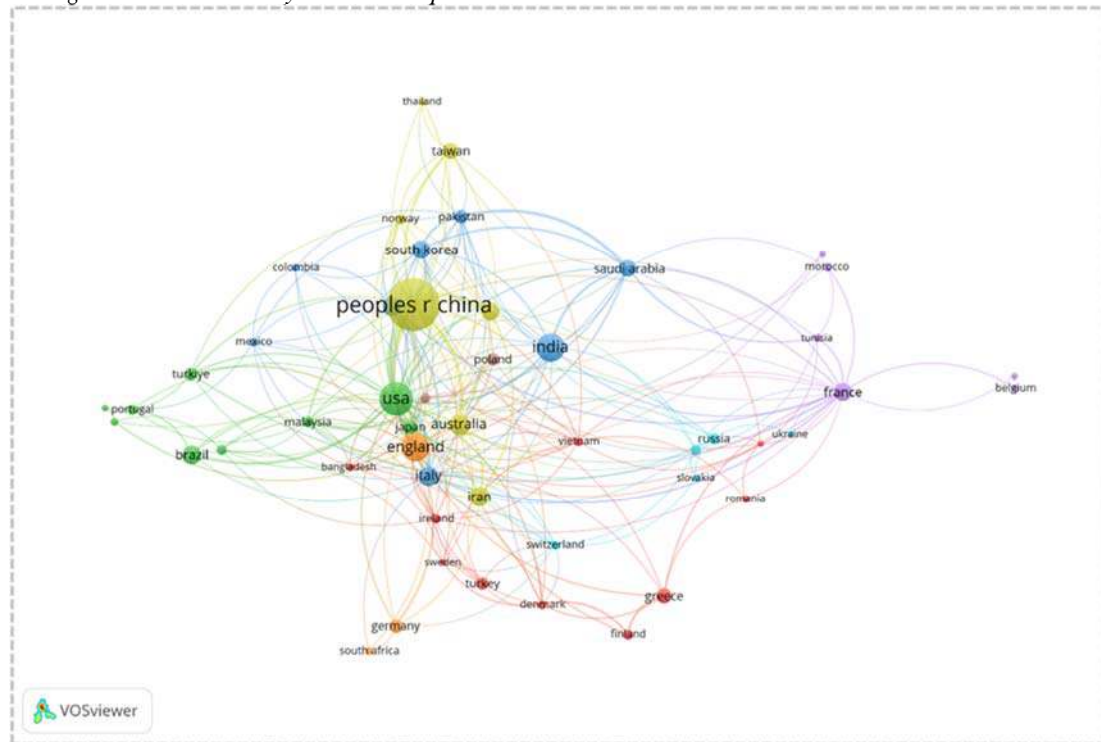


Source: Author contribution using VOSviewer, based on data extracted from Web of Science

The co-citation analysis reflects the intellectual framework of the research domain by examining the connections among 149 frequently cited authors, grouped into five distinct clusters. Each cluster represents a specific thematic area with key contributions from influential authors such as Hochreiter, S., Fama, E.F. and LeCun, Y., whose work in the green cluster links advancements in deep learning to financial theory. Similarly, the yellow cluster, led by Kingma, D.P. and Vaswani, A. focuses on cutting-edge AI methods such as transformers and optimization algorithms, while the red cluster, featuring Zhang, G.P. and Atsalakis, G.S. centers on practical applications in risk management and financial forecasting.

With a total link strength of 33,765 and 7,714 co-citation links, the map demonstrates a well-integrated field with robust connections between artificial intelligence and financial industry. Clusters such as the purple (econometrics and volatility modeling) and blue (text mining and behavioral finance) indicate emerging areas of research. These findings underscore the interdisciplinary nature of the field, where foundational AI techniques are increasingly being applied to solve complex financial challenges. Collaborative efforts between clusters, such as econometrics and applied AI has the potential to foster innovation and to promote a strengthen integration within the research community.

Figure no. 5 The country co-authorship network



Source: Author contribution using VOSviewer, based on data extracted from Web of Science

The country co-authorship network was created using specific selection criteria to identify significant contributors to the research field. In the analysis were included only countries with at least 5 publications and no citation. Among these, the total strength of co-authorship links was assessed, selecting the 51 nations with the strongest collaborative links. For a better visualization, the analysis displayed only the largest connected group which consisted of 50 countries.

The co-authorship network for countries highlights the collaborative landscape in research involving 50 countries grouped into 8 clusters with a total of 450 links, representing co-authorship relationships between nations. Key players like China, USA and India emerge as dominant nodes, reflecting their significant research contributions and robust international collaborations. China dominates the network with the highest link strength, building solid collaborations with nations like the USA, South Korea and India, while the USA acts as a global hub connecting Western nations, including England and Germany, to emerging centers such as Brazil and Malaysia.

The eight clusters identified outline regional or thematic research alliances. For example, China and India dominate a cluster reflecting strong intra-Asian collaboration, while USA and England anchor another cluster focused on transatlantic research partnerships. Smaller clusters, like those centered on France or Russia, highlight regional ties within Europe and North Africa. While the 450 links showcase a well-connected research community, the division into clusters suggests that some regions remain relatively isolated.

5. Conclusions

This study has offered a comprehensive perspective on the current state of deep learning and neural networks in the context of financial markets, including banking industry. It has pinpointed both the strengths of these techniques in specific applications and the gaps that require additional exploration and innovation. The international collaborations and high citation rates of influential documents reflect the global impact and relevance of this research area.

Our work has effectively illustrated the dynamic transformation of financial markets, where deep learning and neural networks are playing an increasingly central role. Through bibliometric analysis, the paper showed the growing adoption and continuous improvement of these methods over traditional approaches.

The present analysis underscored the increasing implementation of AI techniques, including neural networks and deep learning in financial fields. This supports the idea that AI's integration into banking sector is not only growing but shaping the strategic evolution of the industry.

The co-occurrence analysis revealed the central role of deep learning and neural networks in advancing financial market research, particularly in managing uncertainty and improving investment strategies. While progress is evident, gaps persist, such as the limited focus on explainable AI and interpretable machine learning, which imposes the need for transparent and accountable models, especially in regulated financial industries.

The paper emphasized the interdisciplinary nature of AI, highlighting its integration with big data, behavioral finance and computational methods. This demonstrates the potential of AI to tackle critical challenges in banking like customer segmentation, the offer of personalized financial services and dynamic decision-making processes.

Synthesizing the key points, the application of AI, with particular focus on deep learning and neural networks, is strongly impacting the future of banking industry. These techniques equip banks with powerful tools to navigate complexity, mitigate risks and discover new opportunities. Thus, we can admit that the application of AI, like deep learning and neural networks for market dynamics, credit scoring and risk modeling align with banks' strategic objectives to mitigate operational risks and enhance decision-making approaches.

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Interdependencies between Exchange Rate Volatility and Stock Market Sectors: A Case Study of Poland

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Abstract

This study analyzes the transmission of foreign exchange market volatility from the stock market sectors and vice versa, in the case of Poland. The methodology used, spillovers indices, offers the possibility of studying volatility spillovers in different market conditions: bear and bull market. The research considers the system determined by the EUR/PLN exchange rate, stock indices of the sectors and WIG 20, which expresses the overall trend of the evolution of the Polish stock market. The results obtained confirm the spillovers effect and also the variation of volatility spillovers over time and significant differences in spillovers in different market conditions. In normal market conditions, the transmission of volatility is lower compared to the situation where the market is faced with new unexpected positive information but also with new unexpected negative information. The results obtained are important for international investors in diversifying portfolios and for hedging investments.

Key words: stock markets sectors, risk, spillovers volatility, QVAR, spillover index

J.E.L. classification: C58, D53, G15, O57

1. Introduction

The relationship between stock and foreign exchange markets is extensively explored in empirical research for several reasons (Kanas, 2000).. One reason is that stock prices and exchange rates are two variables that are linked (Reboredo et al., 2016). According to economic theory, a depreciation (appreciation) of the domestic currency leads to an increase (decrease) in the international competitiveness of domestic firms and a rise (decline) in cash flows, resulting in higher stock prices. When stock prices rise, international investors liquidate their investments to realize profits, and capital is then reallocated to other countries. The selling of stocks causes the domestic currency to depreciate.

Another reason for studying spillovers between stock and foreign exchange markets is that it provides insights for companies that profit from international portfolio investments and develop risk mitigation strategies: credit institutions, insurance companies, and general investment funds. Multinational corporations, also, are interested in hedging their exposure to exchange rate risk.

A third reason, as highlighted by European Central Bank Vice President Luis de Guindos (2019), is the growing concern about the impact of increased international spillovers on financial stability. Consequently, the interconnectedness between stock and foreign exchange markets has become a focal point for policymakers.

This paper aims to study the dynamics of volatility transmission between sectors of the Polish stock market and the foreign exchange market, using transmission indices determined based on quantile VAR methodology, as proposed by Ando et al. (2022), an improved methodology compared to that initially proposed by Diebold and Yilmaz (2012). We developed a model using indices from ten stock sectors, the Polish capital market index, and the EUR-PLN and USD-PLN

exchange rates. The period considered for the analysis includes a sample from March 11, 2011, to March 10, 2023, the entire period of availability of the sectoral indices. The research objectives are: (1) to estimate the average level of transmission between sectors of the Polish stock market and the foreign exchange market under different market conditions; (2) to estimate the dynamics of volatility transmission; and (3) to identify the moments of vulnerability of each of the two markets.

Transmission indices calculated based on quantile VAR, a method proposed by Ando et al. (2022), allow for the study of connectedness between Polish stock market sectors and the foreign exchange market, in three different market conditions: bear, bull, and normal markets. The normal market situation is highlighted by the analysis performed for the median quantile, while the bear market is represented by the lower tail quantile and the bull market by the upper tail quantile.

This study extends and complements previous research by offering a novel perspective on volatility transmission between stock and foreign exchange markets. While numerous studies have employed the methodology proposed by Diebold and Yilmaz (2012) and its various extensions, it has not been applied to investigate the transmission of volatility between sectors of the stock market and the foreign exchange market. This methodology enables the dynamic study of the intensity and direction of volatility transmission, allowing for the identification of periods with significant spillovers. The patterns identified in the Polish market can provide valuable insights into the dynamics between the two markets. In the model constructed from EUR/PLN and USD/PLN exchange rates and indices of Polish stock market sectors, the methodology allows for the identification of transmissions between each element of the system and the other individual elements.

Furthermore, there is a lack of recent studies analyzing volatility transmission between Polish stock sectors and foreign exchange markets. While Hung (2021, 2022) examines volatility transmission between the foreign exchange rate and five Central and Eastern European stock markets, including Poland, the study focuses on the overall stock market rather than individual sectors. Similarly, there are few published studies investigating volatility transmission between stock sectors and foreign exchange markets in other countries (Yong Fu et al., 2011; Jayasinghe and Tsui, 2008, Jayasinghe et al. 2014, Mouna and Anis, 2017, Fasanya and Akinwale, 2022).

2. Literature review

The relationship between the exchange rate and local stock markets in BRICS countries, alongside the US stock market return and interest rate differentials, is investigated by Sui and Sun (2016) over both the short and long term. Employing VAR and VECM models, the authors find significant short-term transmission of shocks from the foreign exchange market to the stock market, but no significant reverse transmission. The study does not identify any cointegration relationship, thus confirming the absence of long-term transmission. The transmission effect of shocks is found to be more pronounced during the 2008-2009 financial and economic crisis.

Reboredo et al. (2016) examine the volatility transmission between stock markets and foreign exchange markets in a sample of emerging economies. The study aims to highlight both downside and upside risk spillovers. The results confirm a significant bidirectional relationship between exchange rates and stock markets.

Using GARCH-BEKK, CCC, and DCC models, Hung (2022) investigates the transmission effects between exchange rates and stock markets in Central and Eastern European countries. The results confirm bidirectional transmission for Hungary, Poland, the Czech Republic, and Romania. The intensity of transmission varies before, during, and after the subprime crisis. Moreover, the spillover effect of volatility from stock markets to the foreign exchange market is greater than the reverse effect.

The transmission effect of foreign exchange market volatility on the volatility of stock market sectors is analyzed through the estimation of the bivariate GJR-GARCH model for Japan (Jayasinghe and Tsui 2008). The results confirm a positive exposure to yen volatility for sectors such as hardware and information technology, household goods, automobiles and auto parts, and electrical equipment, and a negative exposure for the construction, oil and gas sectors. Moreover, the results confirm an asymmetric effect of volatility transmission.

Fu et al. (2011) examine the linkages between equity sectors and foreign exchange markets in Japan and the US using a BEKK-GARCH model. The results highlight a unidirectional volatility transmission from the exchange rate to equity market sectors when markets are influenced by news shocks, for most sectors in both Japan and the US. An exception is the US technology sector, which exhibits bidirectional transmission. No significant return transmission between foreign exchange markets and stock markets is identified, confirming the hypothesis that testing transmission in the second moment provides different insights compared to testing in the first moment.

Consequently, the research questions that we pose and seek to address in this study are:

R1: *Does the intensity of information spillover vary under normal, bear and bullish market conditions?*

R2: *What is the net direction and intensity of information spillover between each sector of the stock market and the Exchange market?*

R3: *Which sectors of the Polish stock market are connected the strongest with the changes in the Exchange market?*

3. Research methodology

To investigate the connection between exchange rate volatility and each sector of the Polish stock market, we employ a recently developed methodology by Ando et al. (2022): the quantile connectedness approach, a method developed upon the methodology of Diebold and Yilmaz (2009, 2012, 2014).

This method allows us to study volatility transmission within different quantiles, such that: small and large quantiles highlight characteristics that appear in extreme situations, whether negative or positive (bear and bull markets), and the median quantile allows for the identification of volatility transmission characteristics under normal conditions.

Poland is the only country in Central and Eastern Europe that calculates and publishes stock indices for economic activity sectors, for this reason, we have undertaken a study of this research subject.

The sample period for this study extends from March 11, 2011 (first data available for sectoral indices), to March 10, 2023. The dataset includes 3132 daily observations for each sectoral indices, the EUR/PLN and USD/PLN exchange rates, and the WIG 20 blue-chip index. This period encompasses a range of significant economic events, including the final phase of the European debt crisis (January 2010 - December 2012), oil price shocks and the Brexit period (August 2015 - September 2019), the COVID-19 pandemic (January 2020 - November 2020), and the Russo-Ukrainian War (started in February 24, 2022).

The volatility of equity sectors and exchange rate are determined according to the relation:

$$\left| \ln \frac{P_t}{P_{t-1}} \right|$$

where P_t , P_{t-1} - represent the values of the indices on day t and the previous day, $t-1$, respectively.

In order to estimate VAR quantiles, the time series data must adhere to the stationarity assumption. Consequently, we will implement the ERS test (Elliott et al., 1996) in conjunction with the conventional ADF (Dickey and Fuller, 1979) and Phillips-Perron (Phillips and Perron, 1988) tests. Our empirical results unequivocally support the hypothesis of stationarity for all series, as evidenced by the absence of unit roots. Given these findings, and due to space constraints, we focus on the ERS test results. The subsequent VAR(p) model estimation, where each volatility is modeled as a function of its own lags and the lags of other volatilities, is facilitated by the stationarity assumption. Based on information criteria, a VAR(1) model is selected for our quantile connectedness analysis. Ando et al.'s (2022) methodology enables the quantification of spillover effects for each quantile. This includes the spillover direction from one volatility to all others (TO), the spillover direction from all volatilities to one (FROM), net directional spillovers (NET), and the total spillover index (TCI).

4. Findings

4.1 Static volatility transmission analysis

Prior to conducting econometric estimations, we examine the statistical properties of the variables under study. Table 1 presents descriptive statistics of the volatility series for sectoral indices, the stock market index, and the two exchange rates. The results obtained confirm the existence of characteristics specific to financial time series: excess kurtosis, known as fat tails, non-normality of the distributions of the studied series, and their stationarity, as confirmed by the Elliott et al. (1996) test. The highest excess kurtosis of the volatility distribution is observed in the food sector, which reached its highest values during the pandemic caused by the COVID 19 virus.

Table no. 1 Indicators of descriptive statistics of risk for the period March 11, 2011 - March 10, 2023

	Mean	Variance	Skewness	Ex.Kurtosis	JB	p value	ERS	p value
USD	0.545	0.256	2.078	7.497	9585	(0.000)	-8.08	(0.000)
EUR	0.306	0.09	2.491	11.660	20975	(0.000)	-12.30	(0.000)
WIG	0.907	0.867	3.168	24.312	82349	(0.000)	-11.75	(0.000)
BK	1.124	1.445	3.390	24.750	85911	(0.000)	-14.47	(0.000)
BM	1.595	2.498	2.252	9.699	14919	(0.000)	-10.64	(0.000)
CHE	1.259	1.543	2.258	9.104	13474	(0.000)	-6.86	(0.000)
CO	0.87	0.787	2.468	10.740	18226	(0.000)	-15.87	(0.000)
DEV	0.743	0.618	3.041	17.389	44273	(0.000)	-16.36	(0.000)
EN	1.230	1.634	2.693	13.635	28039	(0.000)	-11.39	(0.000)
FOOD	1.057	2.161	11.028	264.160	9166947	(0.000)	-14.82	(0.000)
IT	0.821	0.656	2.223	8.129	11199	(0.000)	-9.03	(0.000)
ME	1.059	1.131	2.272	8.864	12943	(0.000)	-10.42	(0.000)
OG	1.259	1.429	1.905	6.211	6926	(0.000)	-10.79	(0.000)

Note: USD, EUR volatility USD/PLN and EUR/PLN exchange rates, WIG - volatility for Polish stock market, BK, BM, CHE, CO, DEV, EN, FOOD, IT, ME, OG - volatility for Polish stock markets sectors

Source: Results obtained by the authors

Table 2 presents the values of the transmission indices in the lower tail quantile (bear market). The highest volatility transmissions are recorded from the own lagged values, as shown on the diagonal, ranging from 14.37% for the volatility of the USD/PLN exchange rate to 19.09% for the volatility of the entire Polish stock market. The transmission of volatility from the USD/PLN exchange rate to the volatility of equity sectors ranges from the lowest value of 5.46% for the developers sector to the highest value of 5.84% for both the basic materials and IT sectors. However, the volatility transmitted by this exchange rate, USD/PLN, is lower overall than the volatility it receives (with the banking sector being the most influential), justifying the conclusion that it is a net receiver of volatility. The volatility of the EUR/PLN exchange rate is also a net receiver of volatility but receives more than the volatility of the USD/PLN exchange rate, as shown by the net value of -9.16% in Table 2. The volatility of the EUR/PLN exchange rate has the highest transmission to the IT sector at 5.54% and the lowest to the food sector at 5.26%.

Table no. 2 Risk spillovers estimated on the quantile VAR ($q=0.05$)

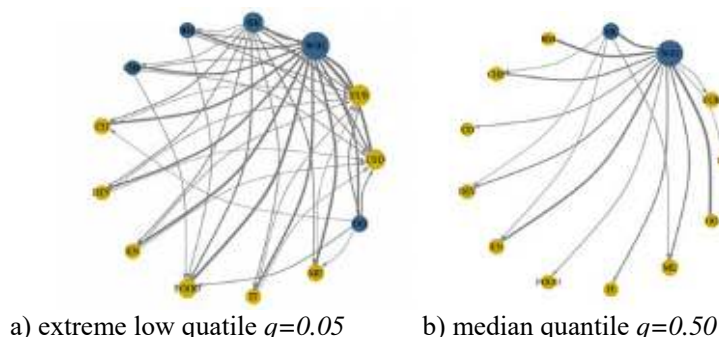
Var	USD	EUR	WIG	BK	BM	CHE	CO	DEV	EN	FD	IT	ME	OG	FROM
USD	19.09	11.78	7.06	6.76	6.64	6.16	6.03	5.92	6.12	5.62	6.32	6.04	6.46	80.91
EUR	12.13	19.6	6.93	6.84	6.39	6.19	5.93	6.00	5.93	5.51	6.13	5.99	6.43	80.40
WIG	5.31	5.1	14.37	11.03	8.58	7.15	6.3	6.63	7.53	5.97	6.78	6.32	8.94	85.63
BK	5.55	5.5	12.07	15.75	7.32	7.01	6.28	6.75	7.01	6.08	6.59	6.41	7.67	84.25
BM	5.84	5.49	10.02	7.82	16.84	7.16	6.48	6.53	7.03	6.1	6.7	6.44	7.54	83.16
CHE	5.51	5.44	8.48	7.61	7.26	17.04	6.93	6.95	7.12	6.48	6.98	6.89	7.30	82.96
CO	5.66	5.43	7.84	7.16	6.9	7.26	17.97	7.33	6.54	6.9	7.28	6.73	7.01	82.03
DEV	5.46	5.39	8.08	7.52	6.83	7.13	7.17	17.58	6.84	6.85	7.23	7.1	6.83	82.42
EN	5.63	5.33	9.20	7.82	7.36	7.32	6.44	6.85	17.53	6.11	6.5	6.6	7.31	82.47
FD	5.49	5.26	7.74	7.21	6.78	7.09	7.17	7.29	6.46	18.71	6.7	6.96	7.12	81.29
IT	5.84	5.54	8.31	7.38	7.05	7.2	7.16	7.25	6.54	6.35	17.67	6.68	7.05	82.33
ME	5.70	5.52	7.92	7.34	6.9	7.29	6.78	7.3	6.76	6.73	6.8	18.04	6.92	81.96
OG	5.61	5.46	10.33	8.09	7.43	7.11	6.54	6.49	6.91	6.37	6.67	6.39	16.59	83.41
TO	73.74	71.24	104.01	92.57	85.43	84.08	79.22	81.31	80.78	75.08	80.68	78.55	86.58	
Incl Own	92.82	90.84	118.37	108.33	102.27	101.12	97.19	98.89	98.31	93.78	98.33	96.59	103.17	TCI= 82.56
NET	-7.18	-9.16	18.37	8.33	2.27	1.12	-2.81	-1.11	-1.69	-6.24	-1.67	-3.41	3.17	

Note: USD, EUR volatility USD/PLN and EUR/PLN exchange rates, WIG - volatility for Polish stock market, BK, BM, CHE, CO, DEV, EN, FOOD, IT, ME, OG - volatility for Polish stock markets sectors

Source: Results obtained by the authors

Figure 1a presents the results of the volatility transmission in the extreme lower quantile of the constructed system. It highlights net volatility transmitters with darker circles (for: overall stock market volatility, chemicals, basic materials, banks, and oil & gas) and net volatility receivers with lighter circles (EUR/PLN and USD/PLN exchange rates, media, IT, food, energy, developers, and construction sectors).

Figure no. 1. Net pairwise directional connectedness network at a) extreme quantile and b) median quantile



Source: Results obtained by the authors

In the median quantile, corresponding to a normal market, the volatility transmissions from exchange rates to Polish equity sectors (as shown in Table 3) are significantly reduced, with values ranging between 1.15% and 2.09%. This confirms the results obtained in other studies that volatility transmissions are much more intense under extreme market conditions. Although the foreign exchange market remains a net receiver of volatility in this situation, the results are lower (5.05% and 5.91% compared to 7.18% and 9.16% in a bear market). Additionally, according to Figure 1b, in the constructed system there are only two major volatility transmitters: the overall stock market and the banking sector.

Table no. 3 Risk spillovers estimated on the quantile VAR ($q=0.50$)

Var	USD	EUR	WIG	BK	BM	CHE	CO	DEV	EN	FD	IT	ME	OG	FROM
USD	58.43	18.01	3.40	2.66	2.86	1.82	2.06	1.43	1.79	1.64	2.23	1.39	2.30	41.57
EUR	18.78	59.72	3.12	2.93	2.11	1.89	1.86	1.45	1.59	1.55	1.56	1.49	1.96	40.28
WIG	2.02	1.62	30.87	16.71	8.54	5.14	3.94	4.12	6.09	3.55	4.43	3.32	9.64	69.13
BK	1.74	1.79	20.55	37.96	5.24	4.42	3.53	3.87	4.66	3.27	3.72	3.22	6.01	62.04
BM	2.09	1.68	12.68	6.26	45.79	4.51	3.72	3.51	4.44	3.17	3.78	3.00	5.37	54.21
CHE	1.55	1.74	8.07	5.77	5.01	46.66	4.98	4.59	4.54	3.86	4.77	3.81	4.65	53.34
CO	1.55	1.41	6.02	4.32	3.80	4.78	53.21	4.86	3.12	4.91	4.74	3.47	3.81	46.79
DEV	1.38	1.29	6.72	5.16	3.99	4.37	4.75	51.93	3.84	4.34	4.67	3.69	3.87	48.07
EN	1.59	1.27	9.83	6.11	4.80	4.87	3.26	3.88	50.35	3.12	3.08	3.13	4.72	49.65
FD	1.34	1.42	5.30	4.21	3.85	4.22	4.96	4.58	2.93	56.27	3.39	3.88	3.66	43.73
IT	1.77	1.45	7.04	4.87	4.25	4.74	5.24	4.45	3.20	3.28	53.00	2.90	3.82	47.00
ME	1.15	1.22	6.06	4.95	3.58	4.58	3.91	4.44	3.74	4.19	3.36	55.50	3.31	44.50
OG	1.57	1.47	14.27	6.97	5.37	4.31	3.67	3.24	4.06	3.34	3.57	2.80	45.38	54.62
TO	36.52	34.37	103.04	70.90	53.42	49.64	45.89	44.42	44.00	40.22	43.30	36.09	53.11	654.93
Incl	94.95	94.09	133.91	108.87	99.21	96.30	99.11	96.35	94.34	96.49	96.29	91.59	98.49	TCI=
Own														50.38
NET	-5.05	-5.91	33.91	8.87	-0.79	-3.70	-0.89	-3.65	-5.66	-3.51	-3.71	-8.41	-1.51	

Note: USD, EUR volatility USD/PLN and EUR/PLN exchange rates, WIG - volatility for Polish stock market, BK, BM, CHE, CO, DEV, EN, FOOD, IT, ME, OG - volatility for Polish stock markets sectors

Source: Results obtained by the authors

In the extreme upper quantile, volatility transmissions from the two exchange rates (USD and EUR) increase in intensity, reaching maximum values of 7.43% for the chemicals sector and 7.44% for the developers' sector, respectively. Although exchange rates still act as net receivers of volatility, the intensity is much lower, the lowest of all three analyzed situations. Regardless of the stock market situation, whether under extreme or normal conditions, volatility in stock market sectors is transmitted to the foreign exchange market, albeit with a different net intensity, highlighting the asymmetry of volatility transmission.

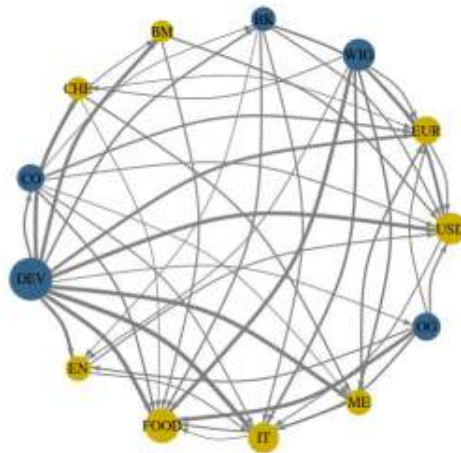
Table no. 4 Risk spillovers estimated on the quantile VAR ($q=0.95$)

Var	USD	EUR	WIG	BK	BM	CHE	CO	DEV	EN	FD	IT	ME	OG	FROM
USD	9.58	8.25	7.54	7.46	7.53	7.43	7.37	7.74	7.41	7.41	7.25	7.46	7.57	90.42
EUR	8.07	9.53	7.51	7.62	7.42	7.55	7.50	7.76	7.38	7.29	7.25	7.56	7.55	90.47
WIG	7.23	7.32	9.06	8.21	7.80	7.58	7.51	7.80	7.55	7.25	7.37	7.38	7.94	90.94
BK	7.28	7.38	8.31	9.24	7.61	7.58	7.64	7.65	7.55	7.25	7.34	7.43	7.75	90.76
BM	7.33	7.38	7.87	7.63	9.43	7.55	7.56	7.79	7.39	7.33	7.53	7.44	7.76	90.57
CHE	7.43	7.43	7.73	7.54	7.58	9.13	7.66	7.85	7.49	7.47	7.53	7.53	7.64	90.87
CO	7.22	7.27	7.58	7.52	7.42	7.58	9.82	7.99	7.56	7.49	7.57	7.50	7.49	90.18
DEV	7.35	7.44	7.70	7.41	7.42	7.47	7.76	9.75	7.69	7.49	7.47	7.48	7.57	90.25
EN	7.24	7.42	7.69	7.67	7.50	7.40	7.66	8.02	9.58	7.44	7.35	7.40	7.63	90.42
FD	7.34	7.39	7.64	7.46	7.52	7.58	7.70	7.91	7.43	9.17	7.51	7.63	7.72	90.83
IT	7.40	7.33	7.65	7.52	7.51	7.62	7.73	7.92	7.50	7.39	9.37	7.41	7.63	90.63
ME	7.39	7.32	7.63	7.49	7.52	7.74	7.62	7.90	7.44	7.45	7.45	9.53	7.52	90.47
OG	7.36	7.38	7.95	7.71	7.69	7.60	7.52	7.70	7.44	7.33	7.40	7.55	9.36	90.64
TO	88.66	89.32	92.80	91.25	90.53	90.67	91.23	94.03	89.84	88.59	89.00	89.77	91.76	1177.45
Incl Own	98.23	98.86	101.86	100.49	99.96	99.80	101.05	103.78	99.42	97.76	98.38	99.30	101.13	TCI= 90.57
NET	-1.77	-1.14	1.86	0.49	-0.04	-0.20	1.05	3.78	-0.58	-2.24	-1.62	-0.70	1.13	

Source: Results obtained by the authors

In a situation of extremely high volatility, the number of net volatility transmitters increases (similarly to the case of very low volatility), but the sectors involved are different. The highest net transmission is recorded for the developers sector at 3.78%, followed by the overall stock market, oil and gas, construction, and banks.

Figure no. 2. Net pairwise directional connectedness network at extreme high quantile



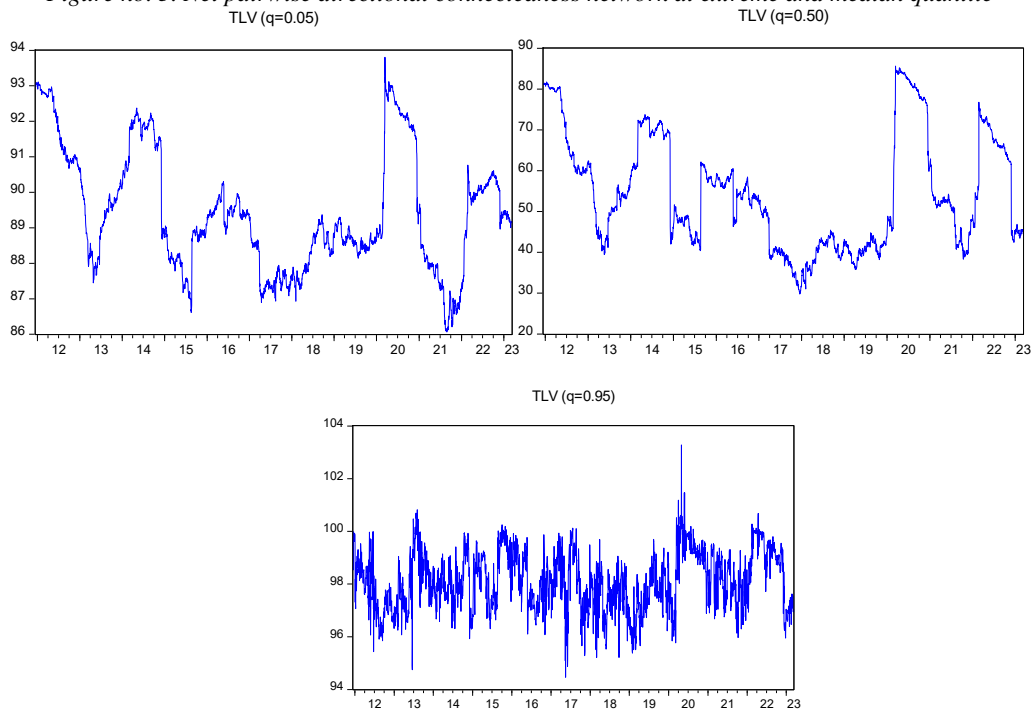
Source: Results obtained by the authors

The total volatility transmission index in the constructed system has the highest value of 93.57% in the extreme upper quantile, 82.56% in the extreme lower quantile, and 50.38% in the median quantile, confirming the existence of much more intense transmission under extreme conditions, which confirms the asymmetry of volatility transmission.

4.2 Dynamic volatility transmission analysis

While the static analysis of volatility transmission allowed us to identify the average level of transmission under different market conditions, we are now interested in examining how the total transmission index evolves over the studied period, also under various market conditions. Figure 3 shows a cyclical evolution of this total volatility transmission index in the extreme lower quantile and in the median quantile, while in the extreme upper quantile a significant fluctuation is observed, without the ability to distinguish volatility cycles.

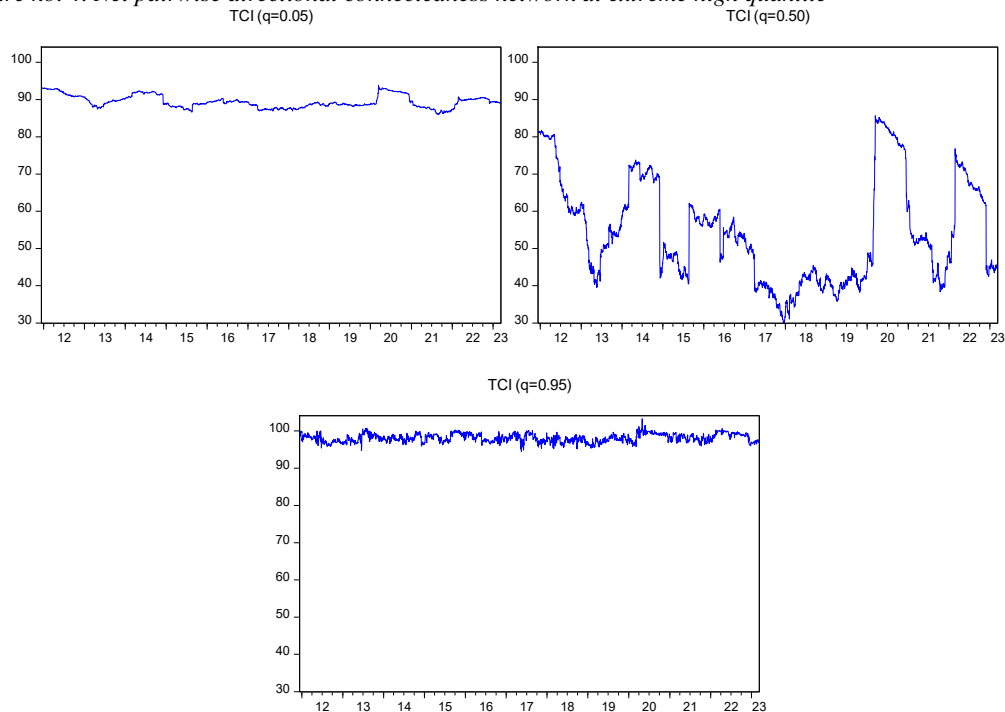
Figure no. 3. Net pairwise directional connectedness network at extreme and median quantile



Source: Results obtained by the authors

Figure 3 captured the evolution of the total transmission index by considering different scale values, allowing us to distinguish potential patterns even in small variations.

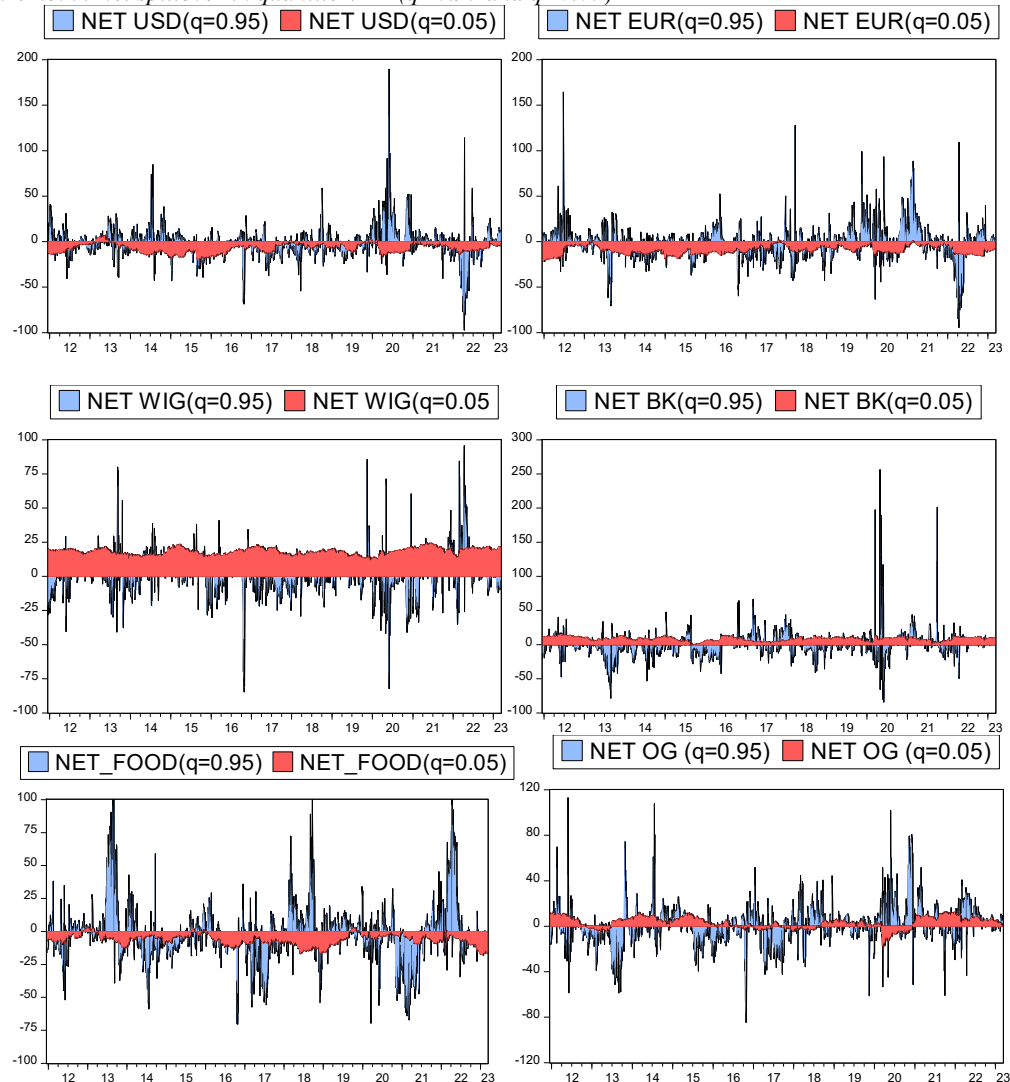
Figure no. 4. Net pairwise directional connectedness network at extreme high quantile



Source: Results obtained by the authors

When considering the same measurement scale (with values falling within the 30% to 100% range), as shown in *Figure 4*, it is evident that, under extreme conditions, the transmission index records very high values and fluctuations are relatively small compared to its value. However, we observe that in the final period of the European Debt Crisis (January 4, 2010 - December 31, 2012), oil crises, Brexit period (August 21, 2015 - September 29, 2019), pandemic period (January 2, 2020 - November 9, 2020), and the Russo-Ukrainian War (from February 24, 2022) until the final date of the sample, as well as in normal market conditions, volatility transmission has increased significantly, reaching maximum values.

Figure no. 5. Net spillover in quantile VAR ($q=0.95$ and $q=0.05$)



Source: Results obtained by the authors

Figure 5 illustrates the net volatility transmission in various extreme situations, as highlighted by the extreme low and high quantiles for several economic sectors and exchange rates. The key finding is the substantial time variation in volatility transmission. While in the extreme low quantile, the transmission index values could be considered "relatively" close, in the extreme high quantile, extremely large variations are the norm. Positive values represent net volatility transmission, while negative values of the index indicate net volatility reception. The banking sector and the PLN/USD exchange rate are characterized by the highest transmission index values, reaching around 250% and 190%, respectively, during the COVID-19 crisis. The PLN/EUR

exchange rate recorded the highest volatility transmission value, 160%, in the first part of the study period characterized by the European Debt Crisis. For both exchange rates, two distinct situations are observed: during the COVID-19 crisis, they were net volatility transmitters; however, with the start of the war in Ukraine, they became net volatility receivers.

5. Conclusions

Studying the transmission of volatility between the foreign exchange market and economic sectors of the stock market reveals essential features necessary for coordinating activities and making specific portfolio management decisions.

By applying quantile VAR to a system created from the volatility of two exchange rates and the indices of economic sectors on the Polish stock market, we identified several important characteristics regarding the transmission of volatility. The research objectives were achieved by identifying the average level of volatility transmission between the foreign exchange markets and the economic sectors of the Polish stock market in different market conditions, estimating the evolution of the transmission level over the studied period, and identifying the extreme points of the volatility transmission level both in the system and for the two exchange rates.

Regarding the first research question, whether the intensity of information spillovers varies in different market conditions, we can affirm that the total transmission of volatility varies and we identified higher transmission values in extreme conditions compared to normal market conditions, which confirms all the researches that had been able to estimate the evolution over time of the volatility connection.

For the second research question regarding the net direction of volatility transmission, we can say that the stock market exerts greater net transmission to the foreign exchange market, a situation that has also been confirmed in other works (Hung, 2022).

The third research question aimed to identify the sectors of the Polish stock market that are the strongest connected with changes in exchange markets. We identified the strongest connections between the volatility of the USD/PLN exchange rate and the basic materials and IT sectors in the extreme low quantile, the basic materials sector in the median quantile, and the chemicals sector in the extreme high quantile. The strongest connections between the volatility of the EUR/PLN exchange rate occur with the IT sector in the extreme low quantile, the chemicals sector in the median quantile, and the developers sector in the extreme high quantile.

Research into volatility transmission can be extended to analyze it between the foreign exchange market and each of the companies that are part of an economic activity sector.

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Analysis of the Evolution of Romanian MTPL Insurance Market Under New Regulations

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Abstract

This paper aims to be an analysis of the Romanian motor third party liability insurance (MTPL) market for the period after the new legislation entered into force. The MTPL insurance market analysis has been done from both quantitative and qualitative perspectives, on the basis of some indicators such as: concentration of MTPL insurance market, penetration rate of the MTPL insurance and MTPL insurance density, the number of contracts, annualized average premium, gross written premiums, gross indemnities paid, the ratio between compensations and written premiums or indicators concerning the direct damage payment option. Where data are available, these indicators are presented also in a distinct manner for individuals and legal entities. The analysis from the paper show two relatively distinct evolutions of MTPL insurance market, namely 2017-2020 and 2021-2023. At the end, some suggestions about aspects that must be improved in the legislation are formulated.

Key words: insurance, motor insurance, third party liability insurance

J.E.L. classification: G22

1. Introduction

In a modern economy, insurance is a complex activity that interacts with many aspects of people's lives. Many activities face different risks and would not take place if there were no insurance, so insurance is fundamental for the functioning of a modern society.

For the Romanian insurance market, car insurance has the largest share, and among this category, compulsory car insurance. „MTPL Insurance is a financial protection system built to prevent any grievance that third parties could face, due to lack of solvency of first party who caused bodily injury or property damage following any event related to a Car Accident”. (Serap Gönülal, 2010, p. 1). As a consequence, MTPL insurance is essential for vehicle owners to protect themselves, their assets, and other parties in the event of an accident. It provides financial coverage, legal protection, promotes responsible driving, and may be a requirement for financing or leasing a vehicle.

Many dysfunctionalities were registered regarding the functioning of this type of insurance in Romania during times and that generated the necessity of a new law. This paper tries to realize an analysis of the MTPL insurance market in Romania after the introduction of this new law (Law no. 132/2017), highlighting different evolutions of the specific indicators by types of customers.

2. Literature review

Some papers analyzed different aspects regarding Romanian MTPL insurance market.

Ioniță et al. (2023) presented in their study the main changes that appeared in the years 2022 and 2023 on the Romanian insurance market, and they mentioned the exit from the market of two insurance companies, the increase in insurance compensations as a result of earthquakes registered in the country, the diversification of insurance services offered to clients by insurance companies, the increase in competition on the insurance market, the reduction of the financial insurance capacity

of the population and some state and private companies as a result of an unstable economic environment. They evidence that the insurance market in Romania is characterized by vulnerability due to the high degree of concentration in terms of exposure to the main classes of insurance, as well as the degree of concentration of insurance companies as result of a small number of such companies. In spite of this, the insurance market from Romania is a dynamic and constantly changing one. Regarding the car insurance market, the authors stated that in the following years their share in insurance will decrease and, instead, the share of property, life and health insurance will increase.

Gheordunescu M. (2022a) identify the trends on the Romanian MTPL car market in period Q1 2016 – Q1 2022 and the registered changes of this type of insurance. The main findings refer to the new amendments to the MTPL legislation and the removal of the reference tariff set by the FSA. The author also predict that most insurance companies will develop digitally, the car insurance market will have a lower market share and that the insurers' profitability and capital will continue to be under pressure. In another article, Gheordunescu M. (2022b) studied the effects of the pandemic on the insurance market. The results of research show that that the interest for some type of insurances (car insurance is among them) resisted even in pandemic period. However, a major deficit of population protection against risks persists.

Analyzing the evolution of the Romanian insurance market by development regions in the period 2016-2019, Ciurea (2021) shows the important contribution of the insurance sector to GDP growth and evidence the substantial contribution to growth of the Bucharest-Ilfov development region, which holds over 44% of the insurance market. The study argues about the adoption of digitization as a solution for the development of the insurance sector.

Lungu et al. (2021) analyzed the Romanian insurance market from the perspective of consumers' perception of insurance. An online questionnaire with 24 questions was applied by the authors to find the perception of Romanian consumers related to insurance the answers show that the majority of the persons (82.31%) consider it a very good measure, 8.84% of the persons compensation that another family member takes care of this aspect, but 4.76% stated that, even they own a MTPL policy, but they do not agree with its obligation. Fewer respondents do not have such insurance and do not want to buy one in the future, preferring to drive without MTPL insurance. Regarding own damage insurance (a Casco policy), most respondents (45.58%) answered that they do not have this type of insurance, because of the high price and 6.80% of the persons declared that they are not interested in such optional insurance.

Other analyses were realized about other MTPL markets in Europe, especially for Eastern and South Eastern Europe.

A study case that analyze the insurance sector business in Central and Eastern European countries in crisis conditions was carried out by Dimić et al. (2018). Their results show that the insurance market in the Central and Eastern European region has great potential for development, but there are numerous challenges that are related to the current financial and economic situation in the region. The insurance sector in the analyzed countries remained stable in times of crisis. No major oscillations were recorded in the level of total insurance premium, market penetration and insurance density.

The Latvian Motor Third Party Liability insurance insurance market was analyzed by Spilberg et al. (2021a) from 2005 till 2019. The authors studied the performance of the Latvian MTPL insurance market. They examines the actual problems of Latvian insurance market in the context of the impact of macroeconomic indicators on MTPL product performance. They conclude that macroeconomic context impact significantly the demand for MTPL. In another article, the same authors (Spilberg et al. 2021b) analyze the impact of macroeconomic factors on the insurance market in Latvia in 2005-2020 and cocnclude that that the evolution of macroeconomic aspects impact significantly MTPL insurance premiums, but also compensations paid for MTPL policies. Their study shows that Harmonised Index of Consumer Prices (HICP), household debt, investments, GDP and net wages growth impact significantly the MTPL premiums, and, on the other hand, household disposable income, private sector debt, household debt, net wages growth and unemployment affect the compensations paid for MTPL policies. They also show that the pandemic impacted more significantly the amount of MTPL premiums compared to with the compensations.

Bobrowski (2022) investigates MTPL market in four Central-Eastern European countries: Czech Republic, Poland, Slovakia and Hungary for 2016-2019 period and the main indicators used were market concentration, market size and compensation cost per policy. The findings of the study show that of the four countries, the MTPL market concentration is the lowest in Hungary and it is the highest in Slovakia. As insurers will accumulate large volumes of data and can also gain access to new data sources such as: traffic violations, the criteria considered for the stability of the insurance cost will become more sophisticated. On the other hand, the markets from all the four countries expect higher levels of MTPL compensations, so, to remain competitive, companies will need to be able to build and manage risk models of substantially increased complexity.

Guggemoos and Wagner (2018) studied the profitability and growth in car insurance sector in Germany. They analyze the influence that the characteristics of the companies could have on indicators of the insurance, such as the premiums, the total compensations and the operating expenses per contract in motor third party liability and motor own damage (OD) for 2002 -2014 period. Their findings are that mutual companies have lower indicators compared to listed companies and, also, that the companies with a higher market share in motor insurance register lower levels of the same indicators compared to that of the companies with a lower market share. Furthermore, direct insurance companies register lower premiums and lower operating expenses per contract compared to companies that sell traditionally through agents or brokers.

Peovski et al. (2022) use panel regression to analyze the MTPL insurance market from Macedonia. They find different characteristics of the MTPL insurance market that influence MTPL premium dynamics during the 2012-2021 period in North Macedonia.

The study of Mecheski et al. (2023) analyzed the growth rate of motor liability insurance compensations, in the attempt to discover if the insurance industry in the Balkan region is facing the phenomenon of social inflation, that is, the abnormal increase in compensations caused by various social factors. For this reason, they analyzed the growth rate of motor liability insurance compensations in 11 countries in the region for the period 2011-2020 and a detailed analysis of the insurance market in the Republic of North Macedonia.

It can be noted that a significant number of analyses were developed regarding MTPL markets during last years, but a comprehensive analysis regarding MTPL Romanian market for the entire period after the introduction of new legislation was not done.

3. Research methodology

The study analyze some statistical indicators regarding the MTPL insurance market in Romania for 2017-2023 period.

The indicators used for the analysis are: concentration of MTPL insurance market, MTPL insurance penetration rate and MTPL Insurance density, the number of contracts, annualized average premium, gross written premiums, gross indemnities paid, the ratio between compensations and written premiums or indicators concerning the direct damage payment option. Where data are available, these indicators are presented also in a distinct manner for individuals and legal entities.

The sources of data are the annual insurance market reports issued by Romanian Financial Supervision Authority (FSA) for the specific insurance data, and the National Institute of Statistics of Romania, for the general statistical data.

4. Findings

The number of companies which had the authorization to sell MTL insurance contracts is relatively reduced in comparison to the total number of non-life insurance companies. For the period 2017-2021, the companies that had the largest market share were the companies City Insurance and Euroins (share market of these two companies between 57,52% in 2017 and 74,86% in 2020). But in the last years, the MTPL market was affected by some important events: the withdrawal of the operating authorization of City Insurance S.A. (september 2021) and the opening of the company's bankruptcy procedure; the official voluntary withdrawal of Uniqa Insurance from MTPL market; the withdrawal of the operating authorization of Euroins (march of 2023). In the same time, the Financial Supervisory Authority (A.S.F.) approved operating authorization for 2 branches of companies from

the European Union to provide MTPL policies - Axeria IARD (end of 2021) and Hellas Direct (end of 2022). Also, in september 2023 FSA approved a new Romanian insurer received the approval for operating on MTPL market – EazyInsurance, but its activity started just in the autumn of 2024. After all these changes, from the companies from Romania remained just seven entities operating on the MTPL market: Allianz-Tiriatic, Omniasig, Asirom, Grawe, Groupama, Eazy and Generali.

Table no. 1 Concentration MTPL market in 2022-2023

Top	2022	%	2023	%
1	Euroins România	32,7%	Groupama	26,3%
2	Groupama	20,4%	Allianz - Tiriatic	20,8%
3	Allianz - Tiriatic	18,7%	Grawe	9,7%
4	Omniasig Vig	6,9%	Asirom Vig	9,0%
5	Asirom Vig	6,6%	Axeria IARD (branches)	8,5%
6	Grawe	5,9%	Euroins	7,0%
7	Axeria IARD (branches)	5,7%	Generali	6,3%
8	Generali	2,8%	Omniasig Vig	6,2%
9	Hellas Direct (branches)	0,3%	Hellas Direct (branches)	6,2%
Market share of the first 2 competitors		53,1%	Market share of the first 2 competitors	47,1%
Market share of the first 5 competitors		85,3%	Market share of the first 5 competitors	74,3%

Source: Insurance market reports 2018-2022, available online at <https://FSAromania.ro/ro/a/970/rapoarte>

The concentration of MTPL insurance market was affected significantly by these changes, and the share covered by the first two MTPL insurers in 2022 became 53,1% and in 2023 – 47,1%, reflecting a more balanced market. In 2022 Euroins remained with 32.7% in first place in the MTPL insurance market, followed by Groupama with 20.4%, but in 2023 Groupama became the new leader on the MTPL insurance market in 2023 with 26.3%, followed by Allianz Tiriatic Insurance with 20.8%. Also, the market share for each insurer, especially in 2023, is more balanced, an aspect that could offer better incentives for competition.

Table no 2 Market penetration degree and density of MTPL insurance market in the period 2017-2023

Year	GDP Mln lei	MTPL GWP	penetration degree (%)	Inhabitants	Density (lei/inhabitant)
2017	857895,7	3.699.187.707	0,43%	19643949	188,31
2018	951.728,5	3.597.074.728	0,38%	19.533.481	184,15
2019	1058973,2	3.783.025.769	0,36%	19.425.873	194,74
2020	1066780,5	3.969.134.369	0,37%	19.354.339	205,08
2021	1189089,8	5.945.972.446	0,50%	19.229.519	309,21
2022	1389450,0	7.473.294.978	0,54%	19.043.098	392,44
2023	1604554,0	7.911.596.711	0,49%	19.054.548	415,21

Source: Tempo on-line statistic database, available online at <https://insse.ro/cms/> and Insurance market reports 2018-2022, available online at <https://FSAromania.ro/ro/a/970/rapoarte>

According to data from table no. 2, the MTPL insurance penetration degree moved from 0,36% in 2019 to 0,54% in 2022 and the MTPL density, expressed in lei, increased from 188,31 lei in 2017 to 415,21 lei. This means that the residents of Romania spends by 2.19 times more money on MTPL insurance products in 2023 compared to 2017.

Comparing the number of existing vehicles in the country at the end of the year for the period 2017-2023 with the number of MTPL contracts, we find that there are more vehicles in circulation, in contrast to the number of MTPL contracts. Part of the explanation consist in the fact that according to MTPL law no. 132/2017, “the MTPL contract can be suspended at the request of the insured who concluded an MTPL contract during the suspension of the right to drive the vehicle according to the legal provisions or during the immobilization of the vehicle, with the obligation to submit the registration/registration plates to the authority that issued them released. (...) The insured has the

obligation to immobilize the vehicle in a private space, outside the public domain, throughout the suspension of the MTPL contract". (law no. 132/2017, article 6 (6)). Another explanation could be that some of the vehicles that move do not have a valid insurance of this kind.

Table no. 3 Evolution of the annual exposure units of MTPL contracts

Year	No of MTPL contracts	% in no. of non life contracts	No. of individuals MTPL contract	% in no. of MTPL contracts	No. Of legal entities MTPL	% in no. of MTPL contracts
2017	5.319.050	37,25%	4.105.789	77,19%	1.213.260	22,81%
2018	5.873.613	39,16%	4.563.947	77,70%	1.309.666	22,30%
2019	5.991.363	43,22%	4.629.580	77,27%	1.361.784	22,73%
2020	6.319.970	42,86%	4.949.940	78,32%	1.370.031	21,68%
2021	7.526.171	56,33%	6.010.318	79,86%	1.515.853	20,14%
2022	6.553.698	46,42%	5.003.690	76,35%	1.550.009	23,65%
2023	6.491.590	45,27%	4.803.091	73,99%	1.688.499	26,01%

Source: own calculation based on Insurance market reports, available online at <https://FSARomania.ro/ro/a/970/rapoarte>

According to data from table no. 3, the number of MTPL contracts had an increasing evolution in the period 2017-2021 because of the increase in the car fleet. The largest share of MTPL contracts within general insurance contracts was registered in 2021 - 56.33%. In the period 2021-2023, the number of MTPL contracts had a decreasing evolution from one year to the next, the share of MTPL contracts in the number of general insurance contracts reaching 45.27% in 2023.

The structure of the number of MTPL contracts by types of clients, individuals and legal persons, show that in the entire analyzed period over 70% of the number of contracts belong to individuals, this weight reaching the maximum of approximately 80% in 2021. In the last two years, the total number, but also the number of the contracts concluded by individuals decreased and this generated a decrease in the share of contracts concluded by individuals, reaching approximately 74% in 2023, and an increase in the share of legal entities contracts, which recorded the maximum value of 26.01% also in 2023.

The evolution of the annualized average premium (AAP), as can be seen in table no. 4, evidence a decrease from 2017 to 2020, followed by an increase in 2021-2023, that generated a bigger annualized average premium in 2022 compared to 2017 by 65.03% and in 2023 by 75.4% compared to 2017.

Although on the total MTPL market the annualized average premium had an increasing evolution, a different evolution of the average annualized premium for individuals and legal entities is noted.

Table no.4 Annualized average premium

Year	AAP for MTPL market (lei)	Index with fixed base 2017	AAP for individuals (lei)	Index with fixed base 2017	AAP for legal persons (lei)	Index with fixed base 2017
2017	695	-	518		1298	
2018	612	88,06%	444	85,71%	1200	92,45%
2019	639	91,94%	472	91,12%	1198	92,30%
2020	626	90,07%	471	90,93%	1181	90,99%
2021	790	113,67%	653	126,06%	1333	102,70%
2022	1140	164,03%	920	177,61%	1853	142,76%
2023	1219	175,40%	977	188,61%	1906	146,84%

Source: own calculation based on Insurance market reports 2018-2022, available online at <https://FSARomania.ro/ro/a/970/rapoarte>

In the period 2017-2020, there is a downward evolution of the average premiums of both individuals and legal entities, and in the period 2020-2023, an increase in the average annualized premiums is observed. The increase of average annualized premium in 2023 compared to 2017 is of 459 lei (88.61% of the average annualized premium in 2017) for individuals and of 608 lei (46.84% of the average annualized premium in 2017) for legal entities. So, the increase was higher for individuals than for legal entities, the average annualized premium becoming in 2023 63,95% of the average annualized premium for legal entities comparative with 53,54% in 2017. It must be mentioned that starting April 2023, the levels of premiums was capped, and this also influence the figures for that year.

Table no. 5 Structure of MTPL gross premiums by customer type

Year	GWP by individuals	% in MTPL GWP	GWP by legal entities	% in MTPL GWP
2017	2.124.851.548	57,44%	1.574.336.159	42,56%
2018	2.025.616.324	56,31%	1.571.458.404	43,69%
2019	2.153.590.180	56,93%	1.629.435.589	43,07%
2020	2.331.349.657	58,74%	1.637.784.713	41,26%
2021	3.925.671.896	66,02%	2.020.300.551	33,98%
2022	4.601.381.828	61,57%	2.871.913.150	38,43%
2023	4.693.380.662	59,32%	3.218.216.049	40,68%

Source: own calculation based on Insurance market reports 2018-2022, available online at <https://FSARomania.ro/ro/a/970/rapoarte>

As a result of the combined evolutions of contracts and average annualized premium, the highest proportion of gross written premiums from individuals into total gross written premiums is of 66,02% in 2021, but in all the years the gross written premiums paid by individuals are higher than those paid by legal entities.

A significant change appeared since 2021 (but especially since 2022) regarding the contracted period of MTPL contracts. In the 2017-2020 period, the largest share of contracts issued from the point of view of the contracting period was held by 6-month contracts, exceeding the share of one-year contracts. The main reason behind such an evolution is that, during this period, the insurance premium for the 6-month policies was half of the insurance premium for the one-year policies, and some of the insured preferred not to immobilize the money in the insurance policies. The share of contracts issued for a period of one month had an upward evolution from 19% in 2017 reaching 27% in 2020, the highest share recorded by this category in the entire analyzed period.

Figure no 1. Evolution of the structure of the number of MTPL contracts according to the contracted period



Source: own calculation based on Insurance market reports 2018-2022, available online at <https://FSARomania.ro/ro/a/970/rapoarte>

Starting from 2021, the structure of the policies according to the contracted period has changed, with a reversal of the situation recorded in the previous period: the share of policies issued for one year has overtaken the share of policies issued for 6 months. In the period 2021-2023, there was an increase in the share of one-year policies from 38% in 2021 to 83% in 2022 and 86% in 2023, while considerable decreases were recorded in the other categories of policies.

The reasons would be that insurance companies have set much higher insurance premiums for 6-month policies compared to the previous period, thus causing policyholders to take out 12-month MTPL policies.

Table no.6 Evolution of gross premiums written (GWP) and gross indemnities paid (GPI) for MTPL policies

Year	GWP MTPL	% in non -life GWP	% Total GWP	GPI MTPL	% in non-life GPI	GPI MTPL /GWP MTPL
2017	3.699.187.707	48,11%	38,13%	2.195.977.172	53,86%	59,36%
2018	3.597.074.728	44,73%	35,47%	2.730.052.957	55,54%	75,90%
2019	3.783.025.769	43,31%	34,42%	3.120.615.937	54,17%	82,49%
2020	3.969.134.369	42,79%	34,53%	3.109.229.239	53,04%	78,34%
2021	5.945.972.446	51,12%	41,75%	3.530.278.855	55,13%	59,37%
2022	7.473.294.978	53,92%	45,27%	3.383.405.673	54,19%	45,27%
2023	7.911.596.711	52,05%	43,55%	3.136.876.049	49,99%	39,65%

Source: own calculation based on Insurance market reports 2018-2022, available online at <https://FSARomania.ro/ro/a/970/rapoarte>

From data provided by table no. 6, we show that the insurance market in Romania is a market dominated by MTPL insurance, the share of MTPL gross premiums written in non-life gross premiums written reached in 2022 the level of 53.92% and in 2023 - 52.05%. The share of MTPL gross premiums written in total gross premiums written was in 2022 at the highest level (45,27%) and at level of 43,55% in 2023. High weights are registered also for the gross indemnities paid. For all the analyzed years, this indicator registered values above 50% (the exception is 2023, with a value of 49,99%), the highest value being registered in 2018 (55,54%).

A significant dynamic registered the MTPL gross written premiums in 2021 and 2022 especially, as for the paid indemnities, the highest values were registered in the same years, but in 2023 the value of gross indemnities paid became comparable with the lower values from 2019 and 2020.

The proportion of gross paid indemnities into gross written premiums registered the highest value of 82,49% in 2019, followed by a value of 78,34% in 2020. After that period, the value of this indicator decreased continuously and reached a value of 39,65% in 2023. Such an evolution of this indicator put some of the companies (especially companies that had significant MTPL portfolio) in a situation of losses.

Table. no. 7 Evolution of Road death and Deaths per mln inhabitants in Romania and UE

Year	Romania			European Union	
	Critical road accident	Road deaths	Deaths per mln inhabitants	Road deaths	Deaths per mln inhabitants
2018	7718	1.867	96	25.058	49
2019	8642	1.864	96	22.653	51
2020	6271	1.646	85,2	18.844	42,3
2021	4915	1.779	92,7	19.823	44,6
2022	4715	1.633	86	20.679	46
2023	4626	1.545	81	20.420	46

Source: authors processing based on data from 15th-19th Road Safety Performance Index Report, RANKING EU PROGRESS ON ROAD SAFETY ON ROAD SAFETY, ETSC European Transport Safety Council

MTPL is used for covering the expenses employed by civil liability of the car drivers, most of them coming from car accidents. Some data about the number of accidents and their consequences are reported by table no. 7.

Failure to adapt the speed to the road conditions and irregular crossing by pedestrians were the most frequent causes of serious road accidents in the period 2018-2023. The main causes of occurrence were cyclists' deviations, failure to give priority to pedestrians and not giving priority to vehicles.

In the period 2018-2022, Romania was in the first place from Europe in serious accidents resulting in deaths or serious bodily injuries, registering the highest number of deaths per 1 million inhabitants, far exceeding the average recorded at the EU level. In 2023, Romania moved to second place in this situation, the first place going to Bulgaria, which registered 82 deaths per 1 million inhabitants.

According to an opinion poll carried out in 2023 by IRES (the Romanian Institute for Evaluation and Strategy) for UNSAR, about 7 out of 10 respondents (73%) are aware that the number of road accidents, but also the amount of compensation paid, influences the cost of the MTPL policy, even if the individual situation of a driver is positive, with no recorded accidents.

Table no. 8 Evolution of MTPL damage file number

Year	Total damage files	Total compensations for damage (lei)	Compensations for damage paid to individuals (lei)	% from total	Compensations for damage paid to legal entities (lei)	% from total
2017	307.713	2.195.977.172	1290183851	58,75%	905793321	41,25%
2018	349.451	2.730.052.957	1650900938	60,47%	1079152019	39,53%
2019	371.680	3.120.615.937	1896876008	60,79%	1223739929	39,21%
2020	345.294	3.109.229.239	1905639104	61,29%	1203590135	38,71%
2021	379.044	3.530.278.855	2370368069	67,14%	1159910786	32,86%
2022	339.608	3.383.405.673	2330451489	68,88%	1052954184	31,12%
2023	291.693	3.136.876.049	1706904029	54,41%	1429972020	45,59%

Source: own calculation based on Insurance market reports 2018-2022, available online at <https://FSARomania.ro/ro/a/970/rapoarte>

A statistical situation regarding the damage files, but also the indemnities paid is reflected by table no.8. In Romania, annually at least 6 vehicles out of 100 registered vehicles cause road accidents resulting in material damage or bodily injury and death. Data from table no. 8 show that the year 2021 registered the largest number of damage files of the analyzed period, and also the highest value of damages paid of 3.530.278.855 lei. 2022 registered the highest share of damages paid to individuals - 68.88%, but the highest value of damages paid to individuals was recorded in 2021 - 2370368069 lei. For legal entities, the highest share of damages paid was registered in 2023 - 45.59%, and the highest value of damages paid was recorded in the same year - 1429972020 lei.

The evolution of the compensations paid is correlated with the evolution of gross written premiums in the sense that the share of compensations paid to individuals is higher than the share of compensations paid to legal entities. The large number of damage files appear because annually, in our country, about 400,000 road accidents are registered, a figure equivalent to over 1,000 accidents/day.

A positive aspect is evidenced in the period 2021-2023, when there is a decrease of 87351 of the number of compensations files in 2023 compared to 2021. This evolution is due to the decrease in the number of road accidents because of some measures taken by the Romanian Police through the activity carried out by the Road Directorate.

Thus, contravention sanctions were applied for violating road rules, but a series of road education campaigns and a series of preventive activities aimed at improving the level of knowledge and respect for road rules, as well as awareness of the dangers to which those who violate traffic rules are exposed, were also carried out.

Also, the data from the insurance market reports show that the largest share of the compensations granted to both individuals and legal entities over 75% is represented by the compensations for material damage, the rest up to 25% representing the compensations paid for bodily injuries. In 2019, the largest share of compensations paid for material damages to individuals was recorded, 80.75%, and in 2020, the highest share of compensations for material damages paid to legal entities was recorded, 81.95%.

A significant aspect introduced by the new law was the direct damage payment option, that permitted to the insured persons who opt for this to be compensated by its own MTPL insurer. The evolution of the indicators regarding this option evidence that in a period with many dysfunctionalities, this was considered a good measure.

Table no. 9 Indicators concerning the direct damage payment option

Indicator	2018	2019	2020	2021	2022	2023
Emitted number of options	301131	205330	221702	388316	352281	491230
GWP for option (lei)	22746898	20217576	21978791	43310544	58323992	90093462
Annualized average premium for option	92	110	112	125	171	187
Number of damage files for option	2577	5124	6119	9709	12161	12529
Compensations paid for option (lei)	14890396	35727972	52222830	79843022	98595502	103499015
Average compensation for option	5778	6973	8535	8224	8108	8261

Source: own calculation based on Insurance market reports 2018-2022, available online at <https://FSAromania.ro/ro/a/970/rapoarte>

Data from table no. 9 show that the number of options that was bought during times registered from 2019 a growing trend, even if the price for this option doubled during times, from 92 lei/year in 2018 to 187 lei/year in 2023. But the number of the damage files that were open based on this option grew from 2577 files in 2018 to 12529 files in 2023 (more than 5 times), the compensations based on the option grew from 14890396 lei in 2018 to 103499015 in 2023 (about 7 times) and the average compensation grew from 5778 lei in 2018 to 8261 lei in 2023 (about 1,4 times). These indicators show that especially in the last years, affected by the withdrawal of the operating authorization of some important MTPL insurers, the option became a valuable policy component.

5. Conclusions

The results show that MTPL insurance is the most important one for the insurance market in Romania. The analysis of the evolution of this market for 2017-2023 period shows two relatively distinct periods: 2017-2020 and 2021-2023. The first period is dominated by a high concentration of the market, a descending annualized average premium, a high level of the ratio between gross indemnities paid and gross written premiums and a high ratio for the contracts for a period of 6 months. The second period, dominated by the withdrawal of the operating authorization of some important MTPL insurers, show a smaller concentration of the market, an annualized average premium that is growing (and more significant for individuals), a high ratio for the contracts for a period of one year, a smaller ratio between gross indemnities paid and gross written premiums.

One of the suggestions about the legislative evolution regarding this insurance refers to the issuance of MTPL policies for the driver of the car and not to the owner, independently by the driver.

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Bibliometric Analysis and Scientific Mapping of Bancassurance Literature

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Abstract

The paper analyzes the research developed on the bancassurance area. It was conducted a bibliometric analysis based on articles and data provided by Web of Science database and using VOS software for bibliometric analysis. Some indicators that reflect the performance analysis are used to reflect the evolution of the research in the bancassurance domain: the number of the publications and the tendency of this indicator, the document type, the most productive journal that published literature in this area, the most productive and most cited authors, the most cited papers, the countries of origins of the authors. Because bancassurance developed uneven in the world, the literature on the subject evolved more rapidly just after the phenomenon developed in many parts of the world, as reflected in our paper. Additionally, a keyword co-occurrence analysis and an occurrence keywords density visualization map were developed to help researchers in the future research on bancassurance.

Key words: bibliometrics, bancassurance

JEL codes: G21, G22

1. Introduction

A developed financial sector is essential for the economic growth. Integration of activities or companies providing financial services was one of the ways used for the development of the sector. A variant of integrating financial services is bancassurance, which is the process of selling insurance products through the bank branches, in an attempt of the banks to diversify their products and adding insurance products was considered a good action. Also, the insurers was interested to obtain new costumers or to enter on new markets. So, the bancassurance constitute a distribution channel used by the insurers, and for using the bank network the insurance companies have to pay a commission to the banks, which find a new source of revenues, along with better services for their clients (Peng et al., 2017). Also, different types of arrangements could be found on this „umbrella” (Teunissen, 2008; Braun et al, 2019; Wu et al., 2009). Another type of interaction between banks and insurers is covered by the term of „assurfinance”, in which „insurance companies are trying to sell savings products via their own networks” (Benoist, 2002, p. 299).

Despite the fact that the creation of Barclays Life in 1965 (Braun et al., 2019, p. 2) is considered the first integration between banks and insurance activities, the development of the bancassurance activities appeared only at the end of the 90s. The development of the bancassurance activities was significantly influenced by the legal aspects. As Artakis et al. (2008) conclude, the development of bancassurance in Europe was positively marked by the Second Banking Directive (1989) and for some countries, like Spain, France or Italy this arrangement become the most important channel of distribution for life insurance. Although the legal framework adopted in USA by the Gramm-Leach-Bliley Act (1999) permitted this kind of arrangements, bancassurance do not developed very much on the American market. In Latin America some of the countries, such as Brazil, Chile or Mexico, also experienced a positive evolution of bancassurance (Peng et al., 2017). Asian countries started to

develop bancassurance only in 2002 (Wu, 2009), but during the years this distribution channel became the most important for life insurance in some significant markets, like China, Taiwan, Hong Kong or South Korea (Peng et al., 2017).

These evolutions generated new problems, like the impact of bancassurance on the performance of entities implied, the decisions regarding the type of arrangement, marketing aspects related. In this context, our paper try to realize a bibliometric analysis regarding bancassurance articles indexed in Web of Science to identify trends in the scientific research of the domain (Teiușan and Sirb(Dulău), 2024).

2. Literature review

In one of the first papers dedicated to bancassurance, Bergendahl (1995) presents some facts about the activity of German banks on the insurance market. After developing financial ratio analysis and data envelopment analysis, Berghendahl (1995) suggest that bancassurance (allfinanz) could be a succesfull strategy for the banks, depending on factors related to cross-selling and standardization.

Numerous papers on bancassurance are dealing with aspects related to performance of such an arrangements, considering the gains, the costs, productivity or profitability, but also dealing with wealth effects generated by this kind of mergers. In that direction, Fiordelisi and Ricci (2011) investigate the comparative cost and profit of italian banks involved into bancassurance with those of banks non-involved, but also for the insurers involved in bancassurance agreements comparative with independent companies and find different results for banks and insurers. The results do not find cost and profit efficiency gains for the banks involved into bancassurance business, but for insurance companies involved into bancassurance arrangements there are cost, but no profit efficiency gains, especially because bank branches are a cheap distribution channel. Also, they find that joint-ventures are the most desired form of bancassurance structure from the cost, but not from the profitability point of view. Another analysis is developed by Peng et al. (2017), which use data for taiwanese banks involved in bancassurance business to analyze the impact of this involvement on their efficiency and profitability. Their conclusion argue for banking involvement into bancassurance business, indicating higher efficiency and profitability. Also, efficiency, but not profitability, could be improved by a diversified strategy.

The wealth effects of the Citicorp and Travelers Group merger are analyzed by Carow (2001) and the findings show a positive effect of stock prices of the large banks and life insurers, but an insignificant effect for small banks and for health or casualty/property insurers, concluding that the benefits of merger for peers institutions are higher than the negative effects generated by the increased competition. Chen and Tan (2011) also analyzed wealth effects and risk effects generated by mergers between banks and insurers for a set of banks in Europe and argue that „bancassurance operating in one country has lower systematic risk compared to other banks” (Chen and Tan, 2011, p. 108), and that the acquirer’s total risks remain constant relative to world or home market indices, but also for home banking index, the same conclusion being evidenced for systematic risk with respect to world market index and home banking index. Another conclusion of the study suggest that mergers generated positive wealth effects. Fields et al. (2007) analyze a set of mergers between banks and insurers and argue for wealth effects for the bidder determined especially by „perceptions of potential economies of scale and scope” (Fields et al., 2007, p. 3660).

Staikouras (2006) analyze non-quantitative aspects of banks-insurers relationship based on European experience and on literature review, and identify exogenous and idiosyncratic elements that could affect the results in terms of succes for bancassurance. Amici et al. (2013) investigate the effect on shareholder value created for bank shareholders by strategic alliances and joint ventures and find that this value is positively influenced when a non-banking financial company is involved in the alliance.

Another research line about the bancassurance regards the types of arrangements involved and their benefits and risks. Benoist (2002) analyze the experience of different countries in the bancassurance area, suggesting some factor that could affect the difference between the importance of such an arrangements and, based on identified benefits and risks and vulnerabilities of bancassurance, determine posible models of bank-insurer interaction. The situation of Irish banking institutions in their attempt to sell insurance products as a way of diversifying their offer is analyzed

by Brophy (2013), which argues for the most convenient bancassurance alliance model in the Irish context. Having in mind the regulations of Central Bank from Ireland, but also the problems that Irish banking system confronted with, Brophy (2013) concludes that most suitable bancassurance arrangements for Ireland are multi tie referral, with banks acting as pure insurance „products distributor or selling branded products developed by an insurer”(Brophy, 2013, p. 329). Wu et al. (2009) propose an evaluation method that could be used by executive management to select the preferable bancassurance alliance structure. They introduce 6 types of alliances (financial holding company, holding shareholding, joint venture, precompetitive alliances, establishing an insurance agency or establishing an insurance brokerage company and, based on the analytical hierarchy process (AHP) and technique for order preference by similarity to ideal solution (TOPSIS), they argue that for Taiwan's bancassurance the financial holding company is preferable.

Various papers deal with the bancassurance mainly from the perspective of a distribution channel. Teunissen (2008) analyze the main bancassurance models and highlight the growing importance of bancassurance as a distribution channel for insurance and the main factors that drive the development of this. Also, based on a study case about ING, he emphasize the benefits for all the participants in bancassurance: insurers, banks and customers. Chang et al. (2011) also analyze bancassurance as a channel of distribution of insurance products and compare the efficiency of bancassurance with that of traditional sales channels, emphasizing that the efficiency scores of bancassurance are significantly smaller than those of traditional channels. Authors' suggestions for insurers managers regard the importance of choosing the bank for partnership in bancassurance and the necessity of more training for banking personnel involved in bancassurance activities. Okeahalam (2008) analyze data coming from four banks in South Africa and find arguments that bancassurance determine economies of scope, that the increase in the number of clients in each bundle market and in the degree of competition in the markets of each bundle reduces fees and that “the bundling of products in a bancassurance package reduces prices” (Okeahalam, 2008, p. 156). The author also argues that “bancassurance bundles are cheaper than similar stand-alone products” (Okeahalam, 2008, p. 160). Hong and Lee (2012) analyze the situation of bancassurance growth in Taiwan and Korea from the perspective of the values appreciated by customers in those countries that generated the growth of cross-buying of insurance products by bank customers. According to their research, the determinants of customers' cross-buying intentions in the banking services were found to be “perceived value”, “trust”, “image” and satisfaction”.

Cummings and Rubio-Misas (2021) analyze the impact of bancassurance on the integration of life insurance markets in European region and suggest that the development of the banking system in countries where bancassurance is the main channel of life insurance distribution “offer benefits for integration improvement in terms of revenue synergies” (Cummings and Rubio-Misas, 2021, p. 199).

Chen et al. (2009) empirically analyze, using data for 71 banks from 28 countries, the determinants of bancassurance, and argue that the decrease of the company risk, the size of the company (which is generally correlated with the customer base), the reduction of company expenses, the increase of the revenue of the company, the size of the national banking market, the level of deregulation, and the inflation rate are the main factors that affect the development of bancassurance activities. But when the authors exclude from the sample the US banks, the size of the company (which is generally correlated with the customer base) and the level of deregulation lose their statistical significance. Casu et al. (2016) investigate the risk involved by mergers between banks and other non-bank financial firms (insurance or securities firms) and suggest that the risks involved by bancassurance are smaller than that of acquiring securities firms, but also that bank size exerts a significant effect on risk.

Marsiglia and Falautano (2005) concentrate in a study case on the challenges that an bancassurance company face in adopting and implementing corporate social responsibilities initiatives.

3. Research methodology

Econometric analysis is employed for "identification of patterns, trends and impact" of the literature about bancassurance (Passas, 2024, p. 1014). For this, it was used the literature, including journal articles, proceedings papers, books or chapter books, covered by Web of Science (WoS) database. From the various applications that is generally used for bibliometric analysis (Moral-Munoz et al., 2020), it was used VosViewer. Because bancassurance developed mostly on last 40 years, but more recently in some parts of the world, we wanted to analyze the literature covered by WoS from the point of view of the number and the tendency of this indicator, the document type, the most productive journal that published literature in this area, the most productive and most cited authors, the most cited papers, the countries of origins of the authors, the link between literature on bancassurance and SDG, but we also developed a bibliometric analysis based on co-occurrence of keywords.

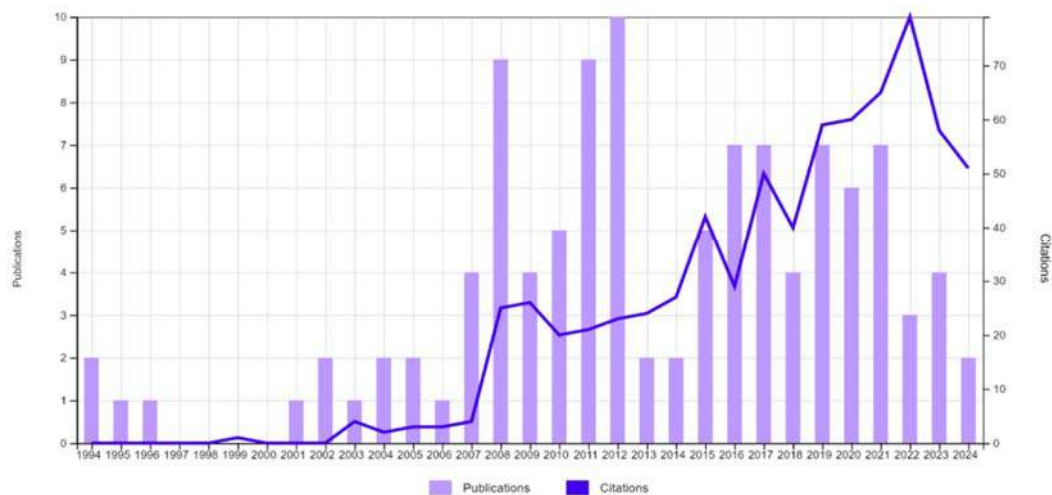
For identifying papers that discuss the bancassurance phenomenon, we used the query for (TS=(bancassurance)) OR TS=(assurfinance), TS being the topic and including the title, the abstract, author' keywords and keywords Plus (Teiuşan and Deaconu, 2021). The source of data was Web of Science Core Collection, and the date of the query – 31 of october 2024. The number of results of the query was 122, from which we excluded editorial materials (2 results) and papers written in other languages than English (10 papers), so remained for analysis a total number of 110 papers. We have not found any bibliometric analysis for bancassurance/assurfinance in the literature identified in WoS.

4. Findings

Analyzing the papers published, it is to note that after the first papers appeared in 1994-1996 followed a period when the subject was abandoned. But starting with the year 2001, the subject started to be analyzed again and the evolution of the published papers is dominated by two periods that cover a significant part of all the literature covered by WoS related to bancassurance. The most important period is 2007-2012 (41 papers) and the second period is 2015-2021 (43 papers).

Also, the number of citations reflect a slow evolutions in the first years, but a significant growth of the yearly citations is registered in 2008 and after that, it can be noticed a trend of growth of the number of citations. At the end of the period analyzed by our paper was registered 716 citations of the documents covered by the analysis and more of 10% of this number was registered in 2022.

Figure no. 1. Papers published and citations received yearly



Source: Web of Science data (31th of October, 2024)

As regards the document type, based on data of Web of Science, we could note that the most significant document type is the journal article (86 documents and 3 documents in early acces status), followed at distance by the proceeding papers (22 documents). An important aspect to be highlighted is that the subject of just one book is related to bancassurance. We highlight the fact that some of the contributions was reflected in two categoris. Analyzing the journals that published papers on topic of bancassurance, it can be noted that *Geneva Papers on Risk and Insurance. Issues and Practice* is the most important one (with 17 published papers), the next one, which is *Journal of Banking and Finance*, publishing just 4 papers on the area. Other journals dedicated to insurance or banking especially, such as *International Journal of Bank Marketing*, *Journal of Risk and Insurance* or *Journal of Risk Finance*, published at least 2 articles. This distribution suggests that a significant interest for this topic was given by the insurance researchers and practitioners.

Table no. 1 Journal that published most of the articles on bancassurance subject

No.	Publication Titles	Number of published articles	% of 110
1	GENEVA PAPERS ON RISK AND INSURANCE ISSUES AND PRACTICE	17	15.455
2	JOURNAL OF BANKING FINANCE	4	3.636
3	GLOBAL BUSINESS REVIEW	3	2.727
4	INTERNATIONAL JOURNAL OF BANK MARKETING	3	2.727
5	JOURNAL OF GREY SYSTEM	3	2.727
6	AFRICAN JOURNAL OF BUSINESS MANAGEMENT	2	1.818
7	JOURNAL OF FINANCIAL SERVICES MARKETING	2	1.818
8	JOURNAL OF RISK AND INSURANCE	2	1.818
9	JOURNAL OF RISK FINANCE	2	1.818
10	SERVICE INDUSTRIES JOURNAL	2	1.818

Source: authors' processing after Web of Science data (31th of October, 2024)

Most of the papers analyzing the subject of bancassurance were published in journals covered by economic categories of Web of Science, the most proeminent being Business, Finance category, which cover almost 50% of the papers.

Table no. 2 The five most important WoS category of the journals publishing articles on the subject of bancassurance

Web of Science Categories	Record Count	% of 110
Business Finance	54	49.091
Business	25	22.727
Economics	22	20.000
Management	20	18.182
Operations Research Management Science	4	3.636

Source: authors' processing after Web of Science data (31th of October, 2024)

The authors witch contributed more in the area are listed in table no. 3. It has to note that only 10 authors (from a total number of 173 authors) have co-authored at least 3 papers and that the biggest number of the papers authored (and co-authored) by an author is 8.

Table no. 3 Most productive authors

No.	Authors	Number of papers	No.	Authors	Number of papers
1	Wu CR	8	6	Ricci O	5
2	Lin CT	7	7	Staikouras SK	5
3	Fan CK	5	8	Fiordelisi F	3
4	Lin YF	5	9	Mutenga S	3
5	Precková L	5	10	Peng JL	3

Source: authors' processing after Web of Science data (31th of October, 2024)

Analyzing the citations received by each document, it can be seen that 9 of the documents received at least 25 citations, the most cited paper received 69 citations and the oldest paper from this group (that received at least 25 citations) was published in 2001.

Table no. 4 Most cited papers

No.	document	citations
1	Baluch F., Mutenga S., Parsons C., <i>Insurance, Systemic Risk and the Financial Crisis</i> , 2011	69
2	Furman E., Wang R., Zitikis R., <i>Gini-type measures of risk and variability: Gini shortfall, capital allocations, and heavy-tailed risks</i> , 2017	58
3	Wu C.R., Lin C.T., Lin Y.F., <i>Selecting the preferable bancassurance alliance strategic by using expert group decision technique</i> , 2009	32
4	Carow KA, <i>Citicorp-Travelers Group merger: Challenging barriers between banking and insurance</i> , 2001	32
5	Peng J.-L., Jeng V., Wang J.L., Chen Y.-C., <i>The impact of bancassurance on efficiency and profitability of banks: Evidence from the banking industry in Taiwan</i> , 2017	31
6	Fields L.P.; Fraser D.R., Kolar J.W., <i>Bidder returns in bancassurance mergers: Is there evidence of synergy?</i> , 2007	29
7	Kulk G.P., Verhoef C., <i>Quantifying requirements volatility effects</i> , 2008	29
8	Staikouras S.K., <i>Business opportunities and market realities in financial conglomerates</i> , 2006	28
9	Benoist G., <i>Bancassurance: The new challenges</i> , 2002	26
10	Puri J., Yadav S.P., Garg H., <i>A new multi-component DEA approach using common set of weights methodology and imprecise data: an application to public sector banks in India with undesirable and shared resources</i> , 2017	23

Source: authors' processing after Web of Science data (31th of October, 2024)

Table no. 5 list the first 10 authors, according to the total number of received citations. From the data revealed by the table, there are 9 authors that received at least 50 citations for the papers contributing in the bancassurance area of research.

Table no. 5 Total citations received by an author

No.	Author	Number of papers	Citations	No.	Author	Number of papers	Citations
1	Mutenga, Stanley	3	86	6	Zitikis, Ricardas	1	58
2	Baluch, Faisal	1	69	7	Fields, L. Paige	2	50
3	Parsons, Chris	1	69	8	Fraser, Donald R.	2	50
4	Furman, Edward	1	58	9	Kolari, James W.	2	50
5	Wang, Ruodu	1	58	10	Wu, Cheng-Ru	8	49

Source: authors' processing after Web of Science data (31th of October, 2024)

From the perspective of the countries contributing on bancassurance we could note a group of 6 countries (Taiwan, Italy, USA, England, India and China) that concentrate most of the research production, but also have to note that the first 2 countries in the rank are from the group of countries where bancassurance represents the most important distribution channels for life insurance.

Table no. 6 Most influential countries contributing on bancassurance subject

No.	Countries/Regions	Documents	No.	Countries/Regions	Documents
1	Taiwan	19	7	Czech Republic	5
2	Italy	12	8	Poland	5
3	USA	9	9	Australia	4
4	England	8	10	Netherlands	4
5	India	8	11	Spain	3
6	Peoples R China	8	12	Wales	3
6 record(s) (5.455%) do not contain data in the field being analyzed					

Source: authors' processing after Web of Science data (31th of October, 2024)

Web of Knowledge permitted us to analyze the link between the published papers and the Sustainable Development Goals. From this point of view, half of the papers are related with SDG09 - Industry Innovation and Infrastructure, considering the change of the relationship between banks and insurers developed in order to attain their own goals, but a significant number of papers are dealing with SDGs (01, 08, 10, 03) that are correlated with peoples level of life, the bancassurance being seen as channel through which banking and insurance products could penetrate better into society.

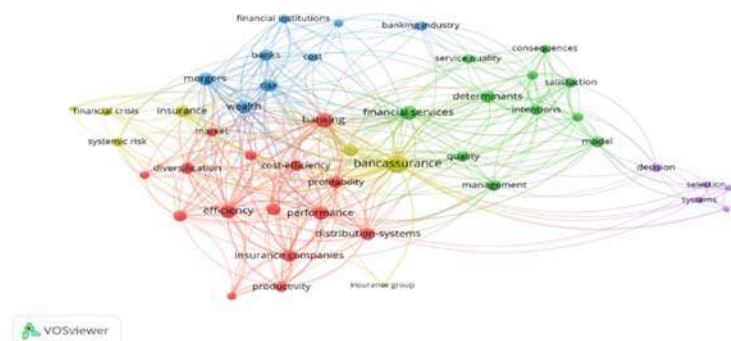
For scientific mapping we used the co-occurrence of keywords and occurrences keyword density.

To facilitate the understanding of the co-occurrence of keywords, figure no. 2 shows the visualization map of bancassurance network. The size of the nodes and the interconnecting lines connecting the nodes denote the relevance and strength of the links (Donthu et al., 2021). This form of analysis is based on the premise that when keywords appear in a publication, the concepts related to those keywords should be closely related. In addition, this form of analysis allows identifying the main research directions. The significance of this analysis lies in the opportunity to identify thematic areas grouped in thematic clusters, so that the main areas of the research field can be described (Fakhar-Manesh et al., 2021).

Using VOSviewer tools, the full count method, all keywords with at least 3 occurrences were extracted. Some of the words with the same meaning were replaced with the same term, so that a more accurate picture of the analyzed topic was obtained, without having duplicate key terms and the relevance of the links not being distorted. The singular terms were replaced by their plural. For example: bank was replaced by banks, cost efficiency by cost-efficiency, insurance company by insurance companies, insurance market by insurance markets, intention by intentions, life insurance by life-insurance.

After replacing, from 410 keywords, 53 keyword met the threshold of at least 3 occurrences for mapping in VOSviewer. The list of this keywords was reviewed again (eliminating keywords expressing the research methods or localization) and finally remain 46 keywords.

Figure no. 2 Network vizualisation map of total links strenght keywords



Source: own processing using the VOSviewer software based on data extracted from the Web of Science database

All the keywords, grouped on clusters, are presented below:

- cluster 1 includes the following 15 items: banking, companies, competition, contextual variables, cost – efficiency, distribution-systems, diversification, efficiency, gains, insurance companies, market, performance, productivity, profitability, scale economies;
- cluster 2 includes the following 11 items: consequences, cross-buying, determinants, financial services, intention, management, model, quality, retention, satisfaction, service quality
- cluster 3 includes the following 8 items: banking industry, banks, cost, insurance markets, financial institutions, mergers, risk, wealth
- cluster 4 includes the following 7 items: bancassurance, credit risk, financial crisis, insurance, insurance group, life-insurance, systemic risk
- cluster 5 includes the following 5 items: decision, project, selection, strategic alliance, systems

Analysis of the map in figure no.2 reveal five main research directions.

The first cluster (marked in red) concentrate on the various aspects of performance and economic effects generated by the bancassurance agreements.

The second cluster (marked in green) reflects the bancassurance as a distribution channel.

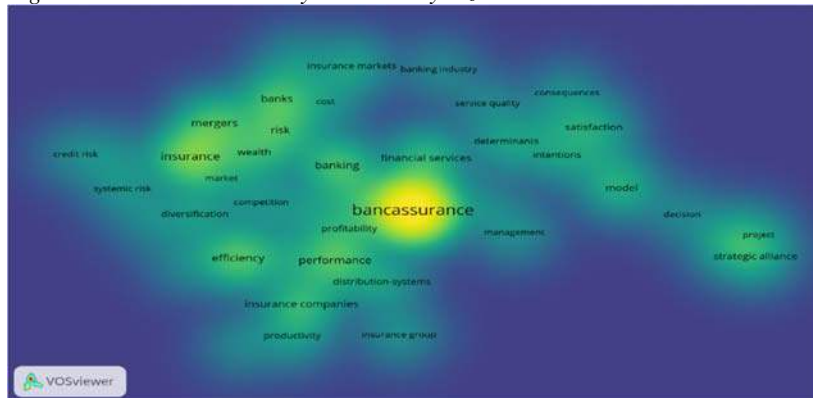
The third cluster (marked in blue) evidence especially the wealth, cost and risk effects of mergers between the two kind of financial institutions: banks and insurers.

The fourth scientific cluster (marked in yellow) reflects the risks involved by the bancassurance.

The fifth scientific cluster (marked in lilla) includes papers dealing with the decisions about the strategic alliances between banks and insurers.

A visual summary of the most important areas on the map and of the most common terms is reflected by the density viewing map (Figure no.3).

Figure no. 3. Occurrences keyword density vizualisation



Source: own processing using the VOSviewer software based on data extracted from the Web of Science database

The keywords that appeared most frequently are presented in table no. 10.

Table no. 10. The words with the most occurrences per cluster

No of cluster	Cluster colors	Keyword	Links	Total strength	Occurance
1	red	banking	30	67	12
		efficiency	26	69	14
		performance	25	59	13
2	green	financial services	28	52	10
3	blue	mergers	24	63	12
4	yellow	bancassurance	45	176	64
		insurance	20	47	19
5	lila	strategic alliance	5	13	7

Source: authors' processing after VOS Viewer results

The keywords reflected by table no. 10 show the predominance as *bancassurance* as keyword, but also suggest that the performance and efficiency of such arrangements or the distribution financial services through bancassurance was amongst the most researched aspects. The questions related to mergers or strategic alliances between banks and insurance companies benefited from a significant investigation.

5. Conclusions

The paper conducted a bibliometric analysis on bancassurance, by using articles and data provided by Web of Science database and VOS software for bibliometric analysis. Some indicators that reflect the performance analysis are used to reflect the evolution of the research in the bancassurance domain. Some concluding remarks could be highlighted: the total number of papers is relatively small and few authors have more than 3 papers, the citations are increasing significantly in the last years, and the most relevant countries that contributed on the analyzed research area are the ones where bancassurance represents the most important distribution channel for life insurance. Also, a keyword co-occurrence analysis and an occurrence keyword density visualization were developed to help researchers in the future research on bancassurance.

Our research has some limitations. The literature covered by our analysis are coming only from Web of Science database, other databases that could contain literature in the area not being included in our research. Another limitation of the study could come from the words used for query. Being a relatively new economic phenomenon, bancassurance could appear under different names, at least in the first years. Also, we analyzed just the bank-insurance companies alliance, not having under attention other types of financial alliances.

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The Evolution of Real Convergence within European Union: Progress, Disparities and Development Perspective

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Abstract

This article evaluates the evolution of real convergence within the European Union, focusing on the progress and disparities that have shaped economic development across member states. Real convergence, a process through which less developed economies improve their economic performance relative to more advanced counterparts, which is essential for achieving economic cohesion within the EU. From this perspective, real convergence plays a significant role in ensuring balanced economic growth and reducing regional disparities, which are essential for maintaining social cohesion and economic stability across the EU. By narrowing the income and development gaps among member states, real convergence supports the EU's broader objective of fostering an integrated and resilient economic union.

Key words: real convergence indicators, regional disparities, European Union, economic integration

J.E.L. classification: H00, H7

1. Introduction

Real convergence has become a central issue in the study of European Union economic integration. The concept refers to the process by which lower-income economies within the EU improve their performance to narrow the economic gap with more developed member states. This phenomenon is measured through real economic indicators such as GDP per capita, labor productivity, and inflation-adjusted income levels. Real convergence is fundamental to the EU's goal of reducing disparities among its member states, fostering economic and social cohesion, and ensuring long-term stability within the Eurozone.

Despite significant policy efforts since the establishment of the Structural and Cohesion Funds, achieving real convergence remains a complex and ongoing challenge. Divergences in economic growth rates, investment in human capital, and structural reforms have resulted in uneven progress across regions (Barro, 1981; Ahmed, 1986). Additionally, external shocks such as the COVID-19 pandemic have exacerbated existing disparities, particularly in Eastern and Southern Europe, according to Ashraf (2020) and Cheval et al. (2020). As such, this paper seeks to explore the dynamics of real convergence, highlighting the role of public policy in addressing regional inequalities and promoting sustainable development within the EU.

2. Literature review

The concept of real convergence, represented by the process through which relatively low-income economies improve their performance to reach the level of more developed economies, has become a subject of significant interest in the analysis of the European Union's economic policies.

Real convergence refers to the process by which countries or regions converge in relation to real economic indicators, such as GDP per capita, labor productivity, unemployment rate, current account deficit, and price levels. This concept is often associated with the idea of catch-up or convergence in terms of economic development.

The relationship between real convergence and nominal convergence is complex and may be influenced by various factors. In the context of a monetary union such as Euro Zone, real convergence can lead to nominal convergence, as countries with lower GDP per capita tend to experience higher inflation rates compared to countries with higher GDP per capita. This can result in a process of nominal convergence, as countries with higher inflation rates tend to experience a depreciation of their currency, which may help reduce inflation differentials.

The existence of real convergence among EU member states is of paramount importance in the process of economic integration, providing a mechanism for achieving economic and social cohesion among countries. Thus, Chang and Rowthorn (1995) mentioned that reducing income inequalities among members has long been a declared objective of the EU, with policies aimed at promoting economic convergence established in 1975 through the Structural Funds and in 1993 through the Cohesion Funds. The idea that European integration through the convergence of macroeconomic policies and increased capital mobility would lead to convergence in income growth rates motivated the implementation of those policies aimed at promoting cohesion.

2. Research methodology

The article employs a rigorous methodology for the collection and analysis of relevant literature. Primary sources include academic journals, books, and research papers published in high-impact journals. The research process involves a critical review of specialized literature, incorporating both quantitative data and information from official sources. The objective of this approach is not only to identify gaps within the field but also to formulate well-supported and coherent conclusions. To ensure a comprehensive evaluation, advanced techniques for synthesizing literature were applied. In addition, multidisciplinary perspectives were considered, highlighting the complexity and significance of the subject, thereby fostering a deeper and more nuanced understanding.

3. Findings

3.1. Evolution of real convergence

Figure no. 1. GDP per capita in 1938



Source: History Nutshell

Figure 1 that represents GDP per capita in Europe during the interwar period illustrates the significant economic disparities among European countries in 1938. These substantial differences in levels of economic development across various European states highlight a harsh economic reality that contributed to the social and political tensions of that era. These economic disparities were further exacerbated by the devastating impact of World War II, which affected European nations irrespective of their economic development. The war resulted in massive infrastructure destruction, considerable human losses, and a general destabilization of national economies, amplifying pre-existing economic crises. In this context, the formation of the European Union became a historical necessity, with its primary goal being the cohesion of European states and the creation of a common market to facilitate post-war economic recovery. Thus, the European Union emerged as a response to the need to prevent further major conflicts, ensuring long-term political and economic stability in Europe. Through the promotion of economic and political cooperation, European states were able to unify their efforts to rebuild war-torn economies and create a favorable environment resilient economic development within the region.

Figure no. 2. GDP per capita 1989 (socialist vs. capitalist)



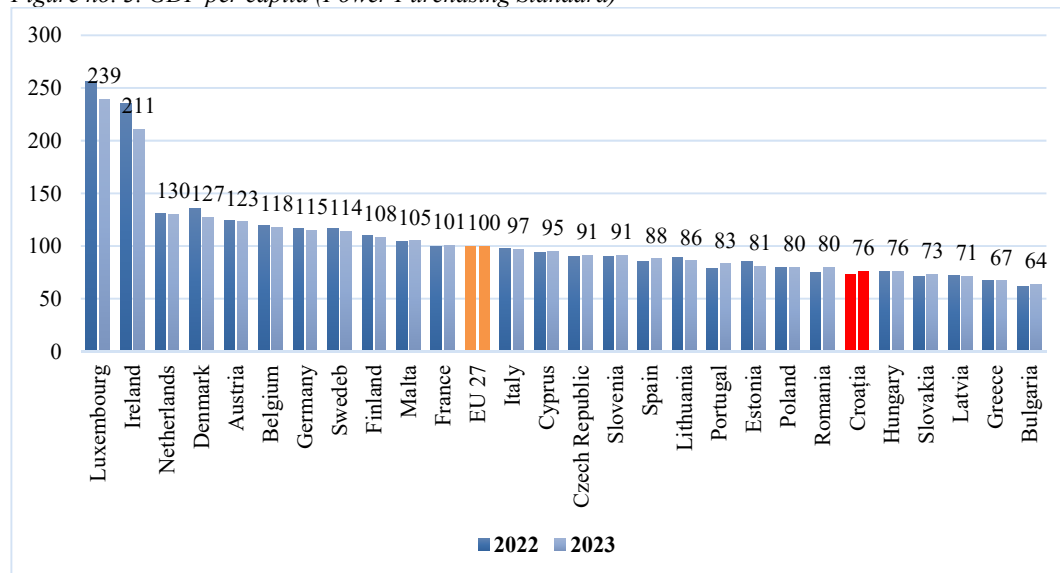
Source: Forummapping

The graphic of GDP per capita illustrates a comparison between various socialist and capitalist countries during the 1980s, with a focus on the inclusion of the Soviet Union and East and West Germany. A significant disparity is observed between the economies of Eastern Europe (represented by red bars) and those of Western Europe (represented by blue bars). The GDP per capita values for Eastern European countries are considerably lower than those of Western Europe. For instance, in Poland, Albania, and Romania, GDP per capita is below \$3,000, in contrast to Luxembourg and West Germany, where values exceed \$30,000. This disparity indicates major economic differences between the two regions, influenced by contrasting political regimes and economic models. Countries from the Eastern bloc, represented by red bars, had centralized, state-planned economies, which limited economic growth and the efficiency of the private sector. These economies, where investments were directed towards heavy industry while the services sector was neglected, generated unequal and insufficient economic development compared to the market economies of the West.

The Soviet bloc was isolated from international markets, limiting access to technology and innovation, unlike Western European states, which benefited from free economic exchanges and integration into global economic systems, such as the Marshall Plan. The progress of Western European countries, represented by blue bars, such as Luxembourg, West Germany, and

Switzerland, shows a GDP per capita of over \$30,000, indicating a high level of economic prosperity. These economies are characterized by robust infrastructure, stable democratic institutions, and market economies that promote entrepreneurship and innovation. Their economic progress was accelerated by several factors, including access to capital, economic integration, the development of a strong services sector, and participation in international trade. The intermediate position of countries like Portugal, Greece, and Spain, with GDP per capita ranging between \$6,000 and \$10,000, reflects a less developed economic status during that period.

Figure no. 3. GDP per capita (Power Purchasing Standard)



Source: Eurostat

According to the chart on GDP per capita in 2022 and 2023, Austria, Belgium, and Germany exhibit high levels of GDP per capita, with Austria recording 123% in 2022 and experiencing a slight increase in 2023. Belgium and Germany remain steady, indicating economic stability. Bulgaria and Romania, positioned at the lower end of the chart with values of 64% and 80% respectively for 2022, show only modest increases in 2023. These figures suggest that both countries are still in the process of economic recovery, remaining far below the EU-27 average. Luxembourg and Ireland lead the rankings, with Luxembourg having a GDP per capita of 239% in 2023, while Ireland registers 211%. These high values reflect highly competitive and globally efficient economies. The Baltic states, such as Estonia and Lithuania, demonstrate significant progress, with Estonia reaching 127% in 2023, signaling rapid real convergence towards the EU average.

The structure of income in GDP for EU member states in 2023 reflects economic diversity and the varying policies of each country. Wages and salaries dominate in most countries, indicating labor-oriented economies and social welfare systems. Social contributions and taxes on production and imports vary, reflecting different models of social protection and fiscal policies. Gross operating surplus and mixed income emphasize the importance of the private sector and economic diversification in certain states. Thus, by analyzing these components, we can better understand the economic structure of each country and the impact of economic and fiscal policies on long-term development and economic stability.

Figure no. 4. The share of income components in GDP 2023

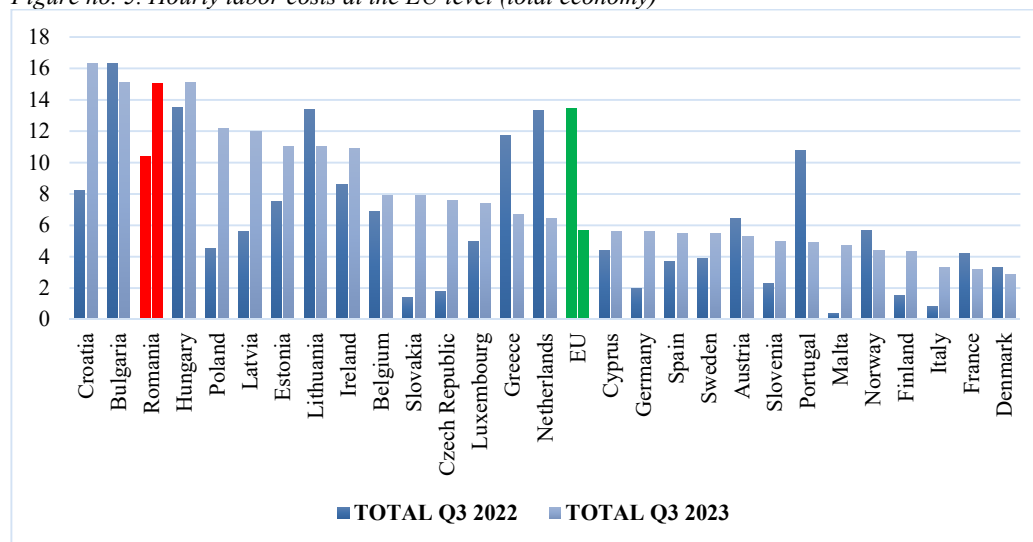


Source: Eurostat

Compensation per employee at current prices is a fundamental economic indicator, reflecting the average income of workers and offering a clear perspective on a country's economic health. The growth of this indicator is crucial in the process of real convergence within the European Union, a process aimed at reducing economic disparities between member states.

In 2023, several countries recorded notable increases in compensation per employee, highlighting improvements in labor markets and contributing to the reduction of economic disparities. Romania, for instance, reported a remarkable rise in compensation per employee, from 250,000 euros in 2022 to 303,000 euros in 2023, a leap that signals a substantial improvement in labor market conditions and incomes, significantly contributing to real convergence. This development is an example of rapid economic progress, driven by foreign direct investment and accelerated economic growth. The rise in incomes directly impacts living standards and may help reduce the phenomenon of labor migration. However, to sustain this growth, it is essential for Romania to implement sustainable economic policies and to strategically invest in education and infrastructure. In other countries, such as Austria and Belgium, the increases in compensation per employee were also notable, though at a more moderate pace, indicating economic stability and well-established labor markets. Conversely, in Italy and Portugal, the declines recorded in 2023 reflect a slight deterioration in economic conditions and a slowdown in the convergence process.

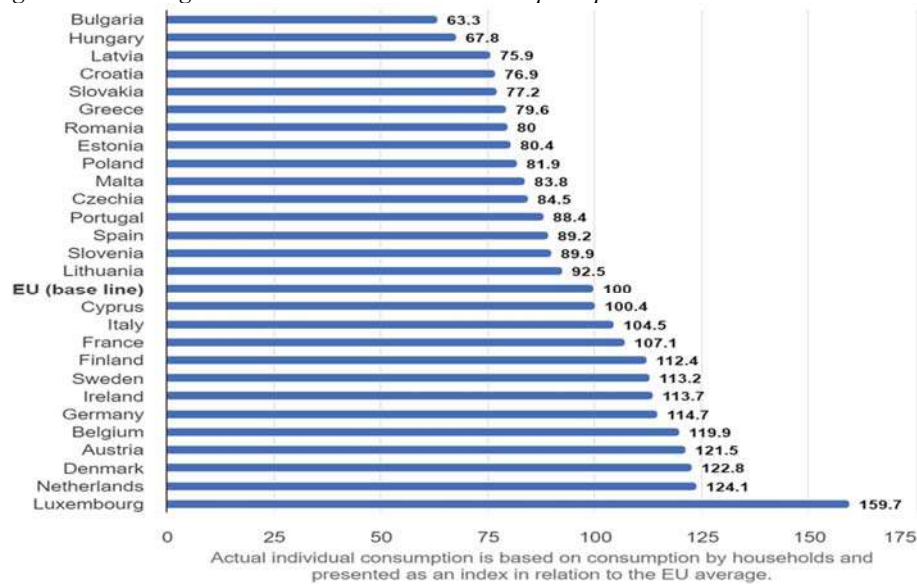
Figure no. 5. Hourly labor costs at the EU level (total economy)



Source: Eurostat

In Q3 2023, compared to the same period in 2022, the European Union recorded significant increases in hourly labor costs across several member states. These increases are crucial in evaluating real convergence. The largest increases in hourly labor costs were observed, in descending order, in Croatia, Bulgaria, Hungary, and Romania. These figures underscore the fact that emerging economies in Eastern and Southeastern Europe are making remarkable progress in improving economic conditions and living standards. The wage increases can be attributed to various factors, including productivity growth, foreign investment, and government policies aimed at fostering economic development. Additionally, other EU member states, such as Latvia, Poland, Lithuania, and Estonia, also registered notable increases in labor costs. These increases reflect ongoing improvements in economic performance and living standards, emphasizing that these economies are on a positive trajectory toward real convergence. The chart clearly highlights regional divergences in the growth of labor costs. Eastern European countries, particularly Romania, Hungary, and Bulgaria, show a faster growth trend compared to Western European states. This trend suggests that these economies are working to reduce economic disparities and align themselves with the higher economic standards of the more developed EU nations.

Figure no. 6. Living standards across the EU: consumption per inhabitant



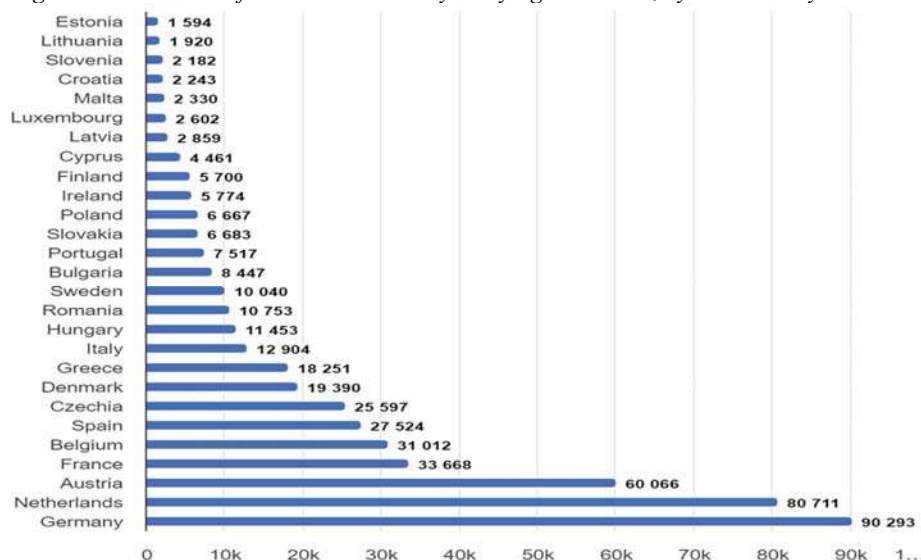
Source: Eurostat

Figure 6 presents the Actual Individual Consumption per capita across different EU countries, expressed as an index relative to the EU average, which is set as the reference point at 100. This serves as a critical indicator for assessing living standards, reflecting the goods and services available to citizens in each country. Countries in Central and Eastern Europe, such as Bulgaria, Hungary, Latvia, Croatia, and Romania, fall below the EU average in terms of AIC per capita. Bulgaria (63.3) and Hungary (67.8) are positioned at the lower end, indicating lower living standards compared to the rest of Europe. This situation reflects reduced consumption capacity, driven by factors such as lower wages, lower productivity levels, and persistent economic disparities between East and West, even after their accession to the EU. While gradual improvements are being made in these economies, the gap with Western Europe remains substantial. Luxembourg, with an index of 159.7, exhibits the highest level of individual consumption, underlining its exceptional standard of living, supported by a strong economy and high per capita income.

Other powerful Western economies, such as the Netherlands (124.1), Denmark (122.8), Austria (121.5), and Germany (114.7), exceed the EU average, reflecting high living standards and sustained economic well-being. These countries are known for their advanced infrastructure, high wages, and well-developed social systems, contributing to elevated individual consumption. Greece (79.6), Romania (80), Portugal (88.4), and Spain (89.2) rank in the lower range of the chart,

with values significantly below the EU average. Although integrated into the European Union and beneficiaries of structural funds for development, these countries continue to face economic challenges such as high unemployment and slower economic growth, which limit the population's purchasing power. Countries like the Czech Republic (84.5), Slovenia (89.9), and Cyprus (100.4) are nearing the European average, indicating a gradual convergence with more developed economies.

Figure no. 7. Students from one EU country studying in another, by host country



Source: Eurostat

Figure 7 shows the number of students from an EU member state studying in another EU country, categorized by host country. This indicator reflects academic mobility within the EU and serves as a crucial parameter in evaluating the attractiveness of educational systems and the opportunities offered to European students for studying abroad. Countries with the highest numbers of international students, such as Germany (90,293), the Netherlands (80,711), and Austria (60,066), attract the largest contingents of students from other EU countries. These nations are renowned for their well-developed educational systems, prestigious universities, and favorable policies for international students, including low or even free tuition fees in some cases. These three countries serve as regional educational hubs, not only because of the high quality of higher education but also due to their strong economies and infrastructure, which make them appealing to students both from an academic standpoint and in terms of post-graduation employment opportunities. France (33,668), Belgium (31,012), Spain (27,524), and the Czech Republic (25,597) are also significant destinations for international students.

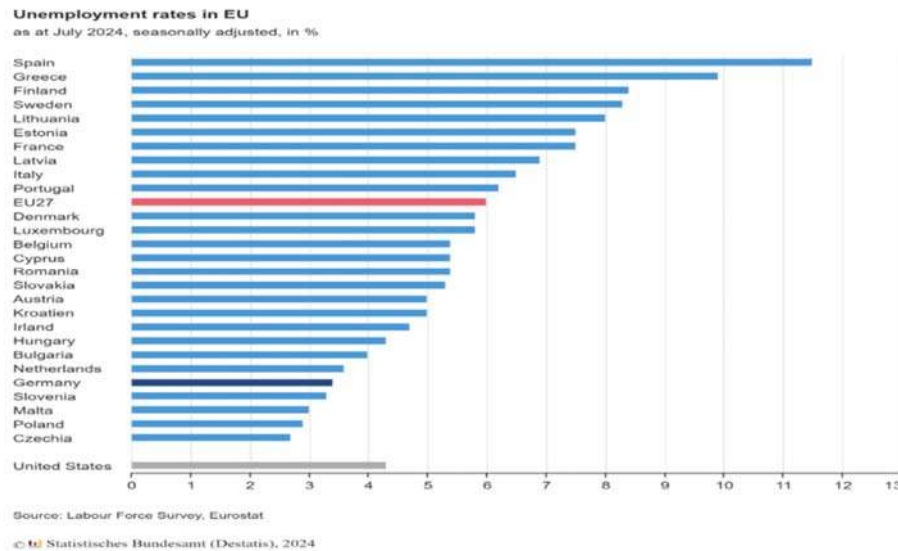
These countries combine prestigious universities with educational programs in multiple languages, including English, increasing their appeal. Spain, for example, is well-known for the popularity of the Erasmus program, offering a diverse and vibrant cultural experience. Belgium and the Czech Republic are also important educational destinations, benefiting from their central geographical location in Europe and high academic standards, particularly in fields such as political science and medicine. Smaller countries or those from Eastern and Southeastern Europe, such as Estonia (1,594), Lithuania (1,920), and Slovenia (2,182), attract a relatively low number of international students. This can be attributed to the smaller size of their university systems and limited resources dedicated to the internationalization of education. However, even in these countries, local universities are beginning to attract students due to educational programs in foreign languages, such as English, and alignment with European quality standards.

Romania occupies an intermediate position, attracting 10,753 students from other EU countries. This indicates growing interest in the Romanian educational system, particularly in fields such as medicine and engineering. However, compared to Western countries, Romania remains a

secondary destination for students, which may be correlated with educational resources and the attractiveness of the local labor market.

Countries with top-ranked universities globally, such as Germany and the Netherlands, naturally attract more students due to their academic prestige and research opportunities. International accreditations and the recognition of diplomas also enhance the appeal of these destinations. Countries with low tuition fees or accessible funding systems, such as Austria and Germany, hold a major competitive advantage. In contrast, countries with high tuition fees for international students, like the United Kingdom (prior to its exit from the EU), may face a decrease in student inflows.

Figure no. 8. Unemployment rates In EU (July 2024)



Source: Labour Force Survey, Eurostat

Figure 8 reveals significant disparities in unemployment rates across the EU as of July 2024. Southern European countries like Spain and Greece show the highest unemployment, indicating ongoing labor market struggles and structural issues. In contrast, Germany, Luxembourg, and the Netherlands demonstrate low unemployment, reflecting stronger economies and efficient labor policies. Emerging Eastern European economies, such as Romania and Hungary, also have relatively low rates, highlighting economic growth, although sustainability remains a concern. Overall, the chart underscores the persistent regional differences in labor market health within the EU.

4.2. NextGenerationEU Plan

NextGenerationEU (NGEU) is a comprehensive financial initiative by the European Union, aimed at supporting post-pandemic economic recovery. With a financial allocation of €806.9 billion, this plan seeks to address the socio-economic damages inflicted by the pandemic, while concurrently fostering long-term growth and resilience, the program is designed with key objectives: stimulating economic recovery, advancing the green and digital transitions, and fortifying the resilience of member states' economies. In the wake of the COVID-19 crisis, economic recovery has emerged as a paramount priority for member states.

By providing substantial financial support, the plan aims to revitalize economic activities and create new jobs, thereby mitigating the negative effects of the economic downturn triggered by the pandemic. This support is crucial for restoring confidence and stability in the affected economies. Another central pillar of the NGEU plan is the facilitation of the green and digital transitions. NGEU aims to enhance the capacity of European economies to withstand future shocks, whether economic, social, or environmental. Through these measures, the NGEU plan aims to ensure a sustainable economic recovery, accelerate the essential transitions for Europe's future, and bolster

the resilience of European economies, preparing them for future challenges. The key components of the NGEU plan include:

- The Recovery and Resilience Facility (RRF), the central element of NGEU, allocates €672.5 billion in grants and loans to EU member states. This facility is intended to support reforms and investments that enhance the resilience of national economies, with a focus on the green and digital transitions.
- REACT-EU, which provides an additional €47.5 billion to support regions most affected by the pandemic, ensuring a balanced recovery across the EU.
- Horizon Europe, a program that allocates €5 billion to support research and innovation, which are essential for stimulating economic growth and competitiveness in the post-pandemic landscape.
- InvestEU, with €5.6 billion, this initiative aims to stimulate investments in various sectors, promoting job creation and sustainable growth.
- The Just Transition Fund, with an allocation of €10 billion, supports the transition towards a carbon-neutral economy, ensuring that no region or community is left behind in this process of transformation.

5. Conclusions

Real convergence is vital for ensuring balanced economic growth and preventing economic and social tensions that could threaten the stability of the EU. In the absence of real convergence, persistent economic disparities may lead to political and economic fragmentation, endangering the entire European space. Public policies play a particularly crucial role in ensuring real convergence. These include fiscal and monetary policies, as well as investment policies in infrastructure, education, research, and development. National governments, along with European institutions, must necessarily adopt sustainable development strategies that support economic growth and reduce disparities among member states. Investments in education and vocational training are essential for enhancing productivity, while investments in infrastructure are necessary to ensure equal access to markets and stimulate economic competitiveness. Concurrently, structural reform policies are imperative for improving the competitiveness of national economies and fostering innovation and technological development.

The role of European institutions, such as the ECB and the EIB, is essential in supporting real convergence. These institutions provide the necessary framework for coordinating economic and financial policies among member states and play a key role in implementing policies that bolster macroeconomic stability. Through their interventions, European institutions significantly contribute to reducing economic disparities and promoting sustainable economic growth.

However, the process of real convergence is complex and protracted, facing numerous challenges. Recent economic crises have highlighted the economic vulnerabilities of the EU and underscored the necessity for adaptable and well-structured public policies. These crises disproportionately impacted the weaker economies within the EU, thereby emphasizing the importance of closer coordination and stronger solidarity among member states. Crisis response policies, including fiscal and monetary measures, have been decisive in stabilizing affected economies and maintaining the convergence process.

In conclusion, to underscore the sustainability and viability of real convergence indicators within the European Union, effective coordination of economic policies at the European level, supported by robust institutions and well-established public policies, is imperative. Only through such an approach can the European Union ensure successful economic integration and equitable development among the economies of member states. This will not only contribute to the economic and political stability of the Union but also enhance social cohesion, thereby ensuring long-term prosperity.

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Value Added Tax in European Union

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Abstract

EU member states he was trying through reforms to create a system as adaptable as possible to future situations and as much as possible the full. Therefore, we find useful an analysis on the efficiency of collecting value tax added to highlight the yield of the tax mechanism. The approach to this problem started from the recent changes to this type of tax and the importance it has among all citizens of the Member States to bear this tax and because it is the largest source of income from indirect taxes. In our research, we set out to focus more on two indicators of efficiency of the VAT at the member states of the European Union, namely: the indicator for assessment of the efficiency of the VAT (VRR) and the indicator of the VAT collection deficit in percentage treatment (VAT gap).

Key words: value added tax, efficiency, gap, finance

J.E.L. classification: G0, G1

1. Introduction

The value-added tax is a consumer tax. It is perceived in all phases of production, but with the possibility of allowing firms to compensate for the tax they have paid for their own purchases of goods and services with the tax they charge for the sale of the final products of goods and services. This tax is largely applicable to all goods and services marketed in the European Union.

However, when the goods are exported, they are no longer charged VAT, and in the case of imports, the VAT tax is added to the value of the goods, to strike a balance in competition on the market of the Member States with those outside the Union. Therefore, the acceptance of this tax may also be one of the transaction taxes. However, VAT can also be characterized as an expense tax, as only consumer spending and not only actual consumption are indirectly taxed (ec.europa.eu)

According to the Court of Justice of the European Union (CJEU), it is the final consumer who supports VAT. The final consumer is the last person in the chain of transactions who does not have the possibility to pass on the amount of the tax. In most cases this is a natural person or company that does not have legal personality.

Prior to the implementation of value added tax, companies were trying to expand their business operations by integrating strategies that would result in reduced tax liabilities and increased revenues. These operations provided incentives for the introduction of a tax that would induce less distortion to the duties already implemented. The basic idea of value added tax was formulated by a German named Wilhelm von Siemens in 1920, and quite influential contributions were made by Maurice Laure in 1953.

By the end of 1960, the notion of VAT and its implementation by the countries had grown until 1970, then the pace of its spread softened for a decade, and then recovered. The table to be represented shows the number of countries that have adopted VAT depending on the regions. In the

initial phase, it is Western Europe that dominates, thanks to The European communities considered its implementation necessary in a common form of sales tax, then Latin America that followed the initiative Brasileira.

South Korea, Israel, Senegal, Turkey, Indonesia and the Ivory Coast are the only countries outside these regions to have adopted VAT around 1980. At the end of this year, it began to be implemented by countries with a transitional economy, developing, especially those in Africa, followed by those in Asia, Pacific and small island economies (Liam Ebrill, Michael Keen and others, 2001).

Table no. 1 The number of countries that have adopted VAT by region

	Sub-Saharan Africa	Asia and Pacific	EU (plus Norway and Switzerland)	Central Europe and BRO ¹	North Africa and Middle East	Americas	Small Islands
2001 (April)	27 (43)	18 (24)	17 (17)	25 (26)	6 (21)	22 (26)	8 (27)
1989	4	6	15	1	4	16	1
1979	1	1	12	0	1	12	0
1969	1	0	5	0	0	2	0

Source: (Ebrill, Keen, Bodin and Summers, 2001)

The financial needs of states are diversified, due to cultural, social or historical factors. To achieve a single internal market, the Treaty of Rome was established in 1957, which provided for the harmonization of indirect taxes and the removal of customs barriers. This indirect tax-focused treaty was implemented, as it was noted that direct taxes do not have as significant an impact on the single market as indirect taxes do. Initially, the VAT system was implemented in France in 1963, but it was not in line with all the approaches of this concept. The first state to adopt the complete system was Denmark in 1967.

The increase in the implementation of the VAT system in Western Europe was accelerated by a series of EEC directives, in which it called on member states to join the European Union for harmonized adoption of the VAT system. More specifically, six directives formulating the theoretical and legislative basis for the introduction of the uniform tax on goods and services. Of the six, three had a greater impact on the form of VAT in the European Union (Anna Kowal, Grzegorz Przekota, 2021).

The first directive introduced in 1967 by the member states of the European Union focused on replacing the turnover taxes with the VAT system, and the second directive contained the structure of this system and how it should be applied. These two directives marked the beginning of the value-added taxation system. When border duties were abolished between EU member states, a transitional VAT regime was addressed, and the sixth directive came as a support in making this regime a definitive one.

Currently, more than 160 countries, including all EU member countries, have adopted the value added tax system. This spread of the VAT system has been regarded as the most remarkable event in the evolution of the tax structure since the middle of the twentieth century.

2. Theoretical background or Literature review

Under European law by introducing directive 2006/112/EC, the implementation of turnover taxes has the role of avoiding distortions that may manifest in by means of the competitive market or to avoid the occurrence of inconvenience in the free movement of goods and services.

This VAT system proved to be easily applicable nowadays, and which fee was charged at a general level and at all stages of manufacturing and processing products, but also services. This common system applied by States members must achieve neutrality in the market sector, regardless of whether the quotas/exemptions which are not sufficiently harmonized.

The transactions considered taxable are those related to the transfer of the goods owned by the owner to the buyer, on purchases made between the member states, on supplies of services, when importing goods from outside the member states of the European Union. Place taxable transactions

depend on how the delivery of goods is made, that is, by transport or without, on board aircraft, ships or trains, or through distribution systems.

A term that European legislation makes known to us is the generator that has as meaning the moment when the indispensable legal conditions are manifested to give the possibility of the appearance of the VAT that becomes chargeable. It becomes chargeable when the tax authority has the right to demand payment of the VAT from the taxpayer. In the situation currently, the preparation of the tax return on VAT payment is mandatory at the period established (ec.europa.eu).

The tax base is the value of a product, a service to which the quota will be assigned corresponding. This tax base is intended to harmonize so that the application of VAT operations in the Member States leads to a level of comparison of results.

Standard VAT rate decided by the European Commission and to be applied by at least 15% of EU members are concerned and the reduced rate for a certain category of goods and services described in Annex 3 under the directive is at least 5%.

Of course, there are certain exceptions to these regulations, if the situation requires preferential treatment. Special rates are as follows: very low quota, zero share, quota of type called "parking".

Table no. 2 VAT rates for European Union member states in 2021

Member States	Code	Super-reduced	Reduced	Standard	Parking Rate	Temporary
Belgium	BE	-	6 / 12	21	12	
Bulgaria	BG	-	9	20	-	-
Czech Republic	CZ	-	10 / 15	21	-	-
Denmark	DK	-	-	25	-	-
Germany	DE	-	7	19	-	-
Estonia	EE	-	9	20	-	-
Ireland	IE	4.8	9 / 13.5	23	13.5	21*
Greece	EL	-	6 / 13	24	-	-
Spain	ES	4	10	21	-	-
France	FR	2.1	5.5 / 10	20	-	-
Croatia	HR	-	5 / 13	25	-	-
Italy	IT	4	5 / 10	22	-	-
Cyprus	CY	-	5 / 9	19	-	-
Latvia	LV	-	5 / 12	21	-	-
Lithuania	LT	-	5 / 9	21	-	-
Luxembourg	LU	3	8	17	14	
Hungary	HU	-	5 / 18	27	-	-
Malta	MT	-	5 / 7	18	-	-
Netherlands	NL	-	9	21	-	-
Austria	AT	-	10 / 13	20	13	5**
Poland	PL	-	5 / 8	23	-	-
Portugal	PT	-	6 / 13	23	13	
Romania	RO	-	5 / 9	19	-	-
Slovenia	SI	-	5 / 9.5	22	-	-
Slovakia	SK	-	10	20	-	-
Finland	FI	-	10 / 14	24	-	-
Sweden	SE	-	6 / 12	25	-	-

Source: ec.europa.eu

The very low share is found in a few of the member countries and occurs if a limited number of products and services are distributed, with quotas below 5%. The zero rate also applies to certain products or services and the final consumer does not have to pay VAT.

Quota type „*parking*” is also named intermediate share and are assigned products and services not included in the annex to the directive number three linked to VAT and quotas are not reduced more than 12%.

The previous table presents the quotas implemented by the member countries of the European Union since 2022, noting that the lowest standard quota is in Malta at 18%, and the highest in Hungary at 27%.

The Directive states that there is also the possibility of exemption from VAT, and most of them are without the right to deduct the VAT, namely to financial, social and insurance and medical care, and those with the right of deduction are for the export of goods between member States or non-EU countries.

The situation in which the goods, wholly or partly deducted, are used for their own purposes or staff and not in the company's activity, are considered onerous deliveries (onerous), except where they are offered as a gift or as samples in the interest of company activity.

3. Research methodology

By analyzing the VAT system, researchers focus on both the burden and the benefits which it brings to the economy. Special attention is focused on the effect of the size of the tax base and the tax rates on the operation of the mechanism on the market. It was found that in general, reforms that are based on broadening the tax base aim to support economic growth, as policy makers offer opportunities to invest, growth of labor, savings and consumption. Reforms in this regard have as a result social welfare and increased production.

Global economic and social changes in recent years have brought the functioning of the tax system to safety. Due to the processes of digitalization, globalization, and modernization of business models, it was necessary to adapt tax administration to them by minimizing the underground economy, expanding the base tax and optimizing key tax instruments. The challenge of fiscal transparency needs to be constantly strengthened and improved, especially those on e-commerce and fast-growing businesses (Abramova, 2021).

The pandemic caused by Covid-19 has brought some changes to the Directive 2006/112/EC, in particular with regard to e-commerce, which will grow from year 2024; will simplify the administrative mode and the compliance with the rules related to VAT, so that the fiscal environment is advantageous for small enterprises starting with the year 2025, allowing VAT exemption with the right to deduct to provide products and services on vaccines and a reduced fee on medical devices. (ec.europa.eu) The regulations in force lead to an appropriate mechanism to mark VAT efficiency.

Each member state of the European Union has implemented the VAT quotas in operation by economic, historical, political, local conditions and more. By this, the governors seek obtain a favorable return on tax. The simplest method of growing the income from taxation is the increase in the rate, but in a certain limited weight.

The improvement in the performance of the tax is noted by broadening the taxable base, using more reduced rates and exemptions, more efficient tax administration and better compliance.

In a quantitative way, the performance of tax collection was marked by the efficiency indicator of a collection of VAT. The purpose of using this indicator is to provide a comparative analysis of the ability of countries to effectively secure the potential tax base for VAT.

4. Findings

According to the study conducted by the OECD team in 2020, the efficiency of VAT collection can also be achieved through the total revenue collected when applying the standard VAT rate to full tax base (VRR). VRR highlights the income collected, in the case where the standard rate would have applied to the entire tax base.

If the default rate of taxation on consumption has a lower result, it can denote the low level of compliance, it does not necessarily refer to the level of tolling. This rate is intended to highlight the level of tax burden related to tax revenue of value added.

Tax evasion and the grey economy are leading to significant losses on national budgets the European Union's. They also greatly affect the deficit of collection of value-added tax.

The tax gap is defined as the difference between the actual tax paid and the tax that should have been paid if all natural and legal people declared in a way appropriate work of the work performed. This can also be defined as the sum of all fraud, unpaid taxes and distortions (Kowal-Pawul, 2021).

Thanks to empirical studies, indicators could be established to determine concretely the level of income that the economy of the country should collect and at the same time, causes that led to when registering the collection deficit (Barbala Mirela, 2017). The main causes that have taken to the different cashing evasion: exemptions, reduced rates, ways to avoid payment (especially the one of carousel type).

The indicator of the VAT gap can be called an indicator of efficiency tax and one of compliance. The general concept of measuring indicator the deficit is relatively simple, so it is found under the formula:

$$\text{VAT gap} = \text{collection deficit at VAT}$$

The default consumption tax rate at European Union level was in a continuous growth from 2018 to 2022. Increasing trend until 2022 highlights the interest that the state has in the indirect taxation system, as well as the share revenue from consumption taxes from total expenditure per consumption.

States of The Northern European Union are the best in this chapter with the highest rate compared to the other areas, and the southern states have the weakest performance. The values of the states in the west and the east seem to be approximately the same until 2022, in which the trend line for one of the areas is decreasing, respectively increasing for the other.

The gap between the average of the EU-north states (maximum value) and the average of the EU-South states (average value) is 3.39 pp in 2021, the biggest difference in the period analyzed. The scale had a decreasing trend until 2019, after which it began to grow. The groups of countries that keep the gap from the average are the northern and southern ones, but the other groups, such as the western group, are moving away from the average, but the eastern group is approaching.

In theory, tax would be more effective if its single rate applied to all consumer goods and services. It has been demonstrated in an empirical study that from the point of view of purely economic and political view, the most effective method is the single quota, because it eliminates additional administration and compliance costs related to exemptions and reduced quotas. However, it was also noted that in certain sectors, these exemptions related to exemptions reduced rates have also brought benefits, such as the achievement of political objectives.

A fairly simple way to measure the effectiveness and productivity that tax derived from the added value it has on the EU is by the share of VAT in GDP.

From table three, it is noted that income from indirect tax from GDP did not increase or significant reductions in the period considered at European Union level. But a continuous decrease can be noted in the case of Ireland, with the biggest difference between the year 2022 And 2021 by about 0.9 percentage points.

It has the lowest result in 2022. It can also be noted that the mechanism of the VAT system is more beneficial in emerging countries than in already developed countries, in some cases exceedingly even the average The European Union, for example, Croatia, Bulgaria, Hungary and others.

Between 2018-2022, Romania is the only country that has changed its standard rate of taxation on consumption, namely from 2018 from 20% to 19% in 2019. This change had as a result the decrease in the percentage of GDP of VAT income, but it was not so much felt at budget revenues.

Table no. 3: Share of VAT collections in GDP

	2017	2018	2019	2020	2021	2022
EU-27	7.1	7.1	7.1	6.9	7.4	7.5
EA-19	6.8	6.9	6.9	6.6	7.1	7.3
Belgium	6.7	6.7	6.6	6.3	6.7	6.5
Bulgaria	9.3	9.1	9.2	9.1	9.4	9.1
Czechia	7.6	7.6	7.5	7.4	7.6	7.9
Denmark	9.4	9.6	9.5	9.9	9.6	9.2
Germany	6.9	7.0	7.0	6.5	7.2	7.4
Estonia	9.0	9.0	8.9	8.9	9.2	9.2
Ireland	4.4	4.3	4.3	3.4	3.8	3.8
Greece	8.3	8.5	8.4	7.8	8.4	9.0
Spain	6.5	6.6	6.5	6.3	6.8	7.0
France	7.1	7.1	7.1	7.0	7.4	7.6
Croatia	12.9	13.1	13.3	12.5	13.1	13.1
Italy	6.2	6.2	6.2	6.0	6.6	7.1
Cyprus	8.5	9.0	8.9	8.1	8.8	9.7
Latvia	8.0	8.4	8.6	8.4	8.6	9.4
Lithuania	7.8	7.7	7.9	8.0	8.3	8.4
Luxembourg	5.8	5.9	5.9	5.8	5.8	6.2
Hungary	9.2	9.5	9.5	9.7	9.9	10.1
Malta	6.8	7.1	6.5	6.4	6.5	6.8
Netherlands	6.8	6.8	7.1	7.4	7.5	7.3
Austria	7.7	7.6	7.7	7.4	7.6	7.9
Poland	7.8	8.1	8.0	8.0	8.6	7.3
Portugal	8.6	8.7	8.8	8.4	8.9	9.4
Romania	6.3	6.3	6.2	6.1	6.4	6.8
Slovenia	8.1	8.2	8.2	7.5	8.2	8.2
Slovakia	7.0	7.0	7.2	7.3	7.5	7.7
Finland	9.0	9.2	9.2	9.2	9.4	9.3
Sweden	9.2	9.2	9.1	9.2	9.1	9.2

Source: Extracted from EUROSTAT website

A more complex version that is also used in statistics for OECD countries, where effectiveness is rendered, is the VRR indicator, becoming a tool through which they can determine the gaps related to the income from consumption taxation.

It's called a regime of pure VAT that situation in which all final consumer expenditure applies to the standard rate. It assumes in theory that the state whose VRR indicator is closer to the value 1, that he'd have a regimen as pure as possible.

The existence of situations where the indicator exceeds value 1 arises because of deviations from the single quota which is applied to all final consumptions, and exceptions and non-collection of tax revenue were not considered.

The moment VRR of the state is close to value 1, this aspect designates that the country can effectively collect their taxes on a large scale, and otherwise, they could designate errors or incompetence of collection of fees. (OECD 2020).

5. Conclusions

It can be concluded that the member states of the European Union in the west have achieved the best results in both the VRR indicator and the VAT gap indicator in percentage treatment. It is worth noting that the deficit of collection the average of the tax at the level of the member states of the European Union decreases with the passage of time, even though consumption increased by 2020.

It was found that the value of the quota's standard does not particularly attract VAT fraud, as noted in the case Croatia and Sweden, and Romania whose deficit is the most at the level of the state's members of the EU have the standard quota below the average of the standard EU quota.

A simple way for member states to increase budget revenues was the high level of standard quotas, because the average standard rate at the level of EU states is approximately 6 p.p. higher than the standard minimum rate allowed by the European Commission.

The COVID-19 pandemic affected the volume of VAT receipts by reducing consumption, but the performance of tax collection was not affected, on the contrary increased in 2020.

By calculating the indicators, I have noted that, over the years of analysis, there has been no increase in the standard rates of VAT, except for Romania in the year 2019, and yet the indicators highlighted the performance of the system, which designates that there are several positive factors of influence of the system.

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The Role of Financial Management in Optimizing the Economic Performance of Companies: Challenges and Perspectives

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Abstract

This paper investigates how financial management practices impact the economic performance of companies. Focusing on capital budgeting, working capital management, and cost optimization, it uses Amazon.com as a case study to demonstrate the link between financial strategies and profitability. The analysis of key financial metrics, such as NPV and working capital efficiency, shows how sound financial decisions support growth and operational success. The study emphasizes the need for businesses to integrate financial management with overall strategy to optimize performance and adapt to evolving market conditions.

Key words: financial strategies, financial management, companies

J.E.L. classification: C51, L25, E37

1. Introduction

In an ever-evolving economic landscape, financial management serves as the backbone of corporate decision-making and strategic planning. Its role extends beyond maintaining financial records or ensuring compliance; it involves optimizing resources, enhancing profitability, and driving sustainable growth. As companies face heightened competition and economic volatility, financial management emerges as a critical function that can determine their long-term viability and success.

Effective financial management encompasses the planning, organizing, and controlling of financial resources to achieve organizational objectives (Brigham and Houston, 2019). It ensures the efficient allocation of capital, cost control, and risk mitigation, all of which contribute to improved economic performance. With the integration of advanced technologies and the increasing complexity of global markets, the scope of financial management has expanded, presenting both opportunities and challenges for businesses across industries (Jones & Clark, 2020).

The purpose of this paper is to examine the pivotal role of financial management in optimizing the economic performance of companies. By exploring theoretical frameworks, contemporary practices, and real-world case studies, the study aims to provide insights into how companies can navigate the challenges of financial decision-making while leveraging emerging trends.

The case study focuses on Amazon.com, Inc., a global leader in e-commerce and cloud computing (Amazon.com, 2023). Amazon's financial management practices, particularly in areas such as working capital optimization, strategic investments, and cost management, exemplify the potential of financial strategies to drive economic performance. Analyzing Amazon's approach provides a practical perspective on the broader theoretical concepts discussed in this paper.

This study is organized into five sections. The first section reviews the theoretical foundations of financial management, emphasizing its significance in corporate performance. The second section outlines the research methodology employed, detailing the data sources and analytical tools used. The findings section highlights key practices and insights derived from Amazon's financial management strategies. Finally, the paper concludes with a discussion of challenges, opportunities, and recommendations for improving financial management practices in the future.

By synthesizing theoretical and practical perspectives, this paper contributes to the understanding of how financial management can serve as a strategic driver of economic performance. In doing so, it aims to equip businesses and scholars with actionable insights to navigate the complexities of financial decision-making in today's dynamic environment.

2. Theoretical background

Financial management is a critical function within an organization, responsible for managing a company's finances to ensure its long-term success and economic performance. The concept of financial management encompasses several core areas: planning, analysis, control, and optimization of financial resources. It is founded on various economic theories and principles that guide the allocation of resources, capital budgeting, risk management, and performance evaluation. Effective financial management not only ensures operational efficiency but also drives sustainable growth, providing a competitive edge in an increasingly complex global market.

At its core, financial management is governed by a few key principles that form the foundation of decision-making and strategic planning:

1. **Time Value of Money (TVM):** This principle asserts that the value of money changes over time due to its potential earning capacity. It is a cornerstone of investment decisions and capital budgeting. In simple terms, money available today is worth more than the same amount in the future due to its potential to earn interest or generate returns. Financial management uses TVM to evaluate investment opportunities, analyze risks, and determine the financial feasibility of projects.
2. **Risk and Return Tradeoff:** This principle suggests that higher returns are generally associated with higher levels of risk. Financial managers must carefully assess this tradeoff when making investment decisions. While businesses seek to maximize returns on their investments, they must also manage and mitigate associated risks. This principle helps companies maintain a balance between pursuing high-growth opportunities and protecting against potential financial losses.
3. **Capital Structure Optimization:** The capital structure refers to the mix of debt and equity used to finance a company's operations and growth. Financial managers aim to achieve an optimal capital structure that minimizes the cost of capital while maintaining financial stability. The Modigliani-Miller theorem (1958) suggests that, in an ideal market, the value of a company is unaffected by its capital structure (Modigliani and Miller, 1958). However, real-world factors, such as taxes, bankruptcy risk, and agency costs, play a significant role in determining the optimal mix of debt and equity.
4. **Financial Planning and Forecasting:** Financial planning involves preparing for future financial needs, managing working capital, and budgeting for both short- and long-term objectives. Effective forecasting techniques help financial managers anticipate future cash flows, allocate resources efficiently, and prepare for economic downturns or unexpected market fluctuations. Financial planning tools such as cash flow analysis, sensitivity analysis, and scenario planning are crucial for ensuring that businesses remain financially healthy and adaptable.

Financial Management and Economic Performance

The link between financial management and economic performance is clear: sound financial decisions enable companies to maximize their profitability, optimize resource allocation, and reduce financial risks. Several key functions of financial management contribute to economic performance:

1. **Capital Budgeting:** Capital budgeting involves evaluating long-term investment opportunities, such as purchasing new assets, expanding facilities, or investing in research and development. Financial management ensures that these investments are made in line with the company's strategic goals and will yield returns that exceed the cost of capital. The most commonly used methods for evaluating capital projects include Net Present Value (NPV), Internal Rate of Return (IRR), and Payback Period. These methods help businesses select the most promising projects and allocate resources efficiently.
2. **Working Capital Management:** Efficient management of working capital—assets and liabilities that are expected to be used or settled within a year—is critical to maintaining liquidity and operational efficiency. Poor working capital management can lead to cash flow issues, which can

hamper a company's ability to pay bills, invest in growth, or weather financial downturns. Financial managers employ strategies such as inventory control, receivables management, and payables management to optimize cash flow and maintain sufficient liquidity.

3. **Cost Management and Profitability Optimization:** Financial management plays a vital role in controlling costs and maximizing profitability. Through financial analysis, managers identify areas where costs can be reduced without sacrificing quality or customer satisfaction. This involves implementing cost-cutting strategies, improving operational efficiency, and negotiating better terms with suppliers. Profitability optimization is also achieved through pricing strategies, market expansion, and improving economies of scale.
4. **Financial Risk Management:** Risk management is essential for safeguarding a company's financial health. Financial managers identify and mitigate risks through the use of various financial instruments, such as hedging, insurance, and diversification. Managing risks associated with fluctuating currency exchange rates, interest rates, and commodity prices is particularly important in a globalized market where external factors can significantly affect a company's performance (Harrison & Lee, 2019).

The Role of Technology in Modern Financial Management

Advancements in technology have significantly reshaped financial management. The use of financial management software, data analytics, and automation tools has streamlined processes, enabling financial managers to make more informed and timely decisions. Technologies such as artificial intelligence (AI), machine learning (ML), and blockchain have enhanced financial forecasting, fraud detection, and financial transactions (Deloitte Insights, 2021). The growing availability of big data has also provided businesses with deeper insights into customer behavior, market trends, and financial patterns, allowing them to make better strategic decisions.

In conclusion, financial management is a multifaceted discipline that encompasses a wide range of activities, all of which are integral to optimizing economic performance. By balancing risk and return, managing capital efficiently, and leveraging modern technological tools, financial managers help companies achieve profitability, growth, and long-term sustainability. The evolving nature of global markets and financial systems demands that companies continually refine their financial management practices to stay competitive and resilient.

3. Research methodology

The research adopts a **case study** design to explore the role of financial management within a large multinational corporation, Amazon. This method is well-suited for understanding complex phenomena in their real-world context. By examining Amazon's financial strategies and how they optimize the company's economic performance, we can derive insights that are applicable to other businesses.

In addition to the case study, **secondary data** has been gathered from reputable sources such as Amazon's annual reports, financial statements, and industry analyses. These documents provide a detailed picture of Amazon's financial management practices, including its approach to capital budgeting, working capital management, and profitability optimization. This data is complemented by a review of academic literature on financial management, which provides the theoretical foundation for the analysis.

To ensure comprehensive analysis, multiple data collection methods were used:

1. **Secondary Data:**
 - o **Amazon's Annual Reports and Financial Statements:** These reports offer detailed information about Amazon's financial performance, capital investments, revenue management, and cost control strategies.
 - o **Industry Reports:** Market research reports from sources such as McKinsey, Deloitte, and Bloomberg were reviewed to understand broader industry trends and best practices in financial management.
 - o **Academic Literature:** A thorough review of academic papers on financial management, corporate performance, and risk management provided the theoretical framework for understanding the role of financial management in optimizing economic performance.

2. Primary Data:

- **Interviews:** Informal interviews were conducted with industry experts and financial analysts who specialize in financial management and corporate finance. Their insights helped contextualize Amazon's financial practices within the broader industry landscape.
- **Observational Data:** Data from Amazon's strategic financial decisions, such as investments in new technologies, acquisitions, and cost-cutting measures, were analyzed to assess how financial management practices contribute to overall economic performance.

3. Quantitative Data:

- **Financial Ratios:** Key financial ratios, such as return on assets (ROA), return on equity (ROE), and operating margin, were calculated using data from Amazon's financial reports. These ratios are useful for assessing the company's efficiency, profitability, and financial health.
- **Capital Budgeting Analysis:** An analysis of Amazon's capital investments was conducted using methods such as Net Present Value (NPV) and Internal Rate of Return (IRR) to assess the effectiveness of their investment decisions in driving economic performance.

The analysis draws on several techniques to assess the relationship between financial management practices and economic performance:

1. **Financial Ratio Analysis:** Financial ratios are calculated to evaluate Amazon's profitability, liquidity, and efficiency. These ratios provide a quantitative measure of how well the company is managing its financial resources. Key ratios include:
 - **Return on Assets (ROA):** Measures how efficiently Amazon uses its assets to generate profit.
 - **Return on Equity (ROE):** Evaluates the profitability of the company in relation to shareholders' equity.
 - **Operating Margin:** Assesses the efficiency of Amazon's core business operations.
2. **Capital Budgeting Techniques:**

The NPV and IRR methods were applied to Amazon's recent investments to determine their financial viability. NPV measures the profitability of investments by calculating the present value of future cash flows, while IRR identifies the rate at which an investment breaks even. These methods provide insights into Amazon's investment decision-making and its impact on overall economic performance.

3. **Comparative Analysis:** The financial management practices at Amazon are compared with those of other leading companies in the e-commerce and technology sectors. This comparison helps to identify industry trends and best practices, offering a benchmark for Amazon's performance and financial strategies.

Amazon was chosen for this case study due to its complex and innovative financial management strategies, which have contributed significantly to the company's success and economic performance. Amazon's ability to optimize its financial resources, manage working capital effectively, and make strategic investments has enabled the company to maintain leadership in a highly competitive and dynamic market (McKinsey and Company, 2022).

Moreover, Amazon's use of technology, such as advanced data analytics and cloud-based financial tools, provides a rich context for exploring modern financial management practices. The company's global operations, which span multiple sectors including e-commerce, cloud computing (AWS), and entertainment, offer a comprehensive view of financial decision-making across diverse business lines.

4. Findings

Capital budgeting is a crucial aspect of Amazon's financial management. The company evaluates large-scale investments using methods like **Net Present Value (NPV)** and **Internal Rate of Return (IRR)**. These techniques help Amazon determine which projects align with its long-term strategy and offer the highest return on investment.

To demonstrate the impact of capital budgeting decisions, let's consider a hypothetical example where Amazon invests in a new logistics center. The company expects the following cash flows over five years:

Table no.1, Cash flow expectancy over 5 years

Year	Cash Flow (USD)
0	-500,000,000
1	100,000,000
2	120,000,000
3	140,000,000
4	160,000,000
5	180,000,000

Source: Author's contribution

- **Initial Investment (Year 0):** \$500,000,000
- **Discount Rate:** 10% (estimated cost of capital)

To calculate the **NPV**, we use the formula:

$$NPV = \sum \frac{CF_t}{(1+r)^t} - I_0$$

Where:

- CF_t is the cash flow at time t
- r is the discount rate
- I_0 is the initial investment

$$NPV = \frac{100,000,000}{(1+0.10)^1} + \frac{120,000,000}{(1+0.10)^2} + \frac{140,000,000}{(1+0.10)^3} + \frac{160,000,000}{(1+0.10)^4} + \frac{180,000,000}{(1+0.10)^5} - 500,000,000$$

$$NPV = 90,909,091 + 99,173,553 + 105,336,527 + 109,632,279 + 111,320,000 - 500,000,000$$

$$NPV = 106,371,450 \text{ (Positive NPV)}$$

Since the NPV is positive, Amazon would consider this investment as economically viable, contributing positively to its long-term growth.

Additionally, the **Internal Rate of Return (IRR)** can be calculated by finding the discount rate that makes $NPV = 0$. This calculation would typically require iterative methods or the use of financial software, but assuming the IRR is 18%, this confirms that the project provides a return greater than the company's cost of capital, further solidifying its financial decision.

Working Capital Management

Amazon's approach to working capital management focuses on optimizing inventory, receivables, and payables to ensure liquidity and operational efficiency. One of the key metrics in working capital management is the **Cash Conversion Cycle (CCC)**, which measures how efficiently a company manages its inventory and receivables.

The **Cash Conversion Cycle (CCC)** is calculated using the formula:

$$CCC = DIO + DSO - DPO$$

Where:

- **DIO** (Days Inventory Outstanding) = $\frac{\text{Average Inventory}}{\text{COGS}} \times 365$
- **DSO** (Days Sales Outstanding) = $\frac{\text{Average Accounts Receivable}}{\text{Revenue}} \times 365$
- **DPO** (Days Payables Outstanding) = $\frac{\text{Average Accounts Payable}}{\text{COGS}} \times 365$

Using data from Amazon's financial reports, we assume the following averages for one year:

Table no. 2. Amazon's yearly averages

Metric	Value
Average Inventory	\$5,000,000,000
Cost of Goods Sold (COGS)	\$40,000,000,000
Average Accounts Receivable	\$2,500,000,000
Revenue	\$500,000,000,000
Average Accounts Payable	\$4,000,000,000

Source: Author's contribution

Now, let's calculate each component:

$$DIO = \frac{5,000,000,000}{40,000,000,000} \times 365 = 45.625 \text{ days}$$

$$DSO = \frac{2,500,000,000}{500,000,000,000} \times 365 = 1.825 \text{ days}$$

$$DPO = \frac{4,000,000,000}{40,000,000,000} \times 365 = 36.5 \text{ days}$$

$$CCC = 45.625 + 1.825 - 36.5 = 10.95 \text{ days}$$

A **CCC of 10.95 days** indicates that Amazon is able to convert its investments in inventory and receivables into cash in under 11 days, a sign of efficient working capital management. This allows Amazon to reinvest its cash quickly into new projects or reduce debt, optimizing its financial performance.

Profitability Optimization and Cost Management

Amazon's profitability optimization is driven by its ability to control costs and enhance operational efficiency. One of the primary metrics used to measure profitability is the **Operating Margin**, which indicates the percentage of revenue that remains after paying for variable costs.

Operating Margin is calculated using the formula:

$$\text{Operating Margin} = \frac{\text{Operating Income}}{\text{Revenue}} \times 100$$

Assume Amazon's operating income for the past year is \$20 billion and its revenue is \$500 billion:

$$\text{Operating Margin} = \frac{20,000,000,000}{500,000,000,000} \times 100 = 4\%$$

An **operating margin of 4%** reflects Amazon's ability to generate profit from its core operations, considering the vast scale and cost structure of its business. While this is a relatively low margin for a technology-driven company, it is consistent with Amazon's focus on reinvesting profits into growth and expansion rather than maximizing short-term profitability.

Financial Risk Management

As a global leader, Amazon faces various financial risks, including currency exchange fluctuations, interest rate changes, and commodity price volatility. To manage these risks, Amazon employs hedging strategies, such as using derivative contracts to protect against adverse currency movements, particularly in Europe and Asia. The company's use of such financial instruments allows it to maintain stable cash flows and protect margins from volatile external factors.

5. Conclusions

This paper has demonstrated the critical role of financial management in optimizing the economic performance of companies. The core functions of financial management—capital budgeting, working capital management, cost control, and financial risk management—are all essential for driving profitability, operational efficiency, and long-term growth.

Capital budgeting ensures that companies invest in projects with the highest returns, guiding resource allocation and promoting financial sustainability. Techniques like Net Present Value (NPV) and Internal Rate of Return (IRR) are valuable tools for evaluating investment opportunities.

Working capital management optimizes liquidity by managing short-term assets and liabilities. Efficient management of inventory, receivables, and payables ensures businesses can meet obligations while funding growth opportunities.

Cost optimization is crucial for maintaining profitability. Through cost-cutting measures and efficiency improvements, companies can protect margins, even in competitive markets. Balancing cost control with investment in innovation helps drive long-term success.

Financial risk management is essential for mitigating risks from market fluctuations, currency shifts, and interest rate changes. By employing hedging and diversification, companies can stabilize cash flow and safeguard their financial position.

All things considered, effective financial management is vital for companies to enhance economic performance, adapt to market changes, and achieve sustainable growth. It provides the strategic framework necessary to manage resources efficiently, reduce risks, and secure long-term profitability. Financial management is not just about short-term gains but about positioning companies for future success in an ever-evolving global market.

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Pricing Policy as a Strategic Tool in the Context of Global Competition

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Abstract

This paper examines the role of pricing policy as a strategic tool for companies in global markets. It explores key pricing models, including value-based and dynamic pricing, and analyzes how these strategies help businesses maintain competitiveness. Using Tesla, Inc. as a case study, the paper highlights how the company adapts its pricing in response to market conditions and regional factors. The findings show that effective pricing strategies, such as localized pricing and dynamic adjustments, are crucial for maximizing profitability and market share. This study underscores the importance of aligning pricing decisions with broader strategic goals to achieve sustainable competitive advantage.

Key words: consumer price, inflation, monetary and fiscal policies

J.E.L. classification: E30, E31, E37

1. Introduction

In an increasingly interconnected global economy, companies face relentless pressure to differentiate themselves and secure competitive advantages. Pricing policies have emerged as a cornerstone of strategic decision-making, influencing not only revenue generation but also brand positioning, customer perception, and market penetration (Smith, 2020; Johnson & Lee, 2021). In this context, the adoption of dynamic and well-informed pricing strategies becomes essential, particularly for businesses navigating global competition where consumer preferences, regulatory environments, and cost structures vary widely (Porter, 2008; Chen et al., 2019).

Pricing is no longer a mere reflection of production costs or a simple response to market demand. It is a sophisticated tool that intertwines economic principles with strategic management practices. Organizations are now leveraging pricing to achieve a variety of objectives, such as capturing market share, maximizing profitability, addressing inflationary pressures, and responding to competitive threats. Moreover, as digital transformation reshapes industries, pricing strategies increasingly rely on data analytics and machine learning to predict customer behavior and adapt in real-time.

The purpose of this paper is to examine pricing policy as a strategic tool in the context of global competition. This research seeks to understand how businesses utilize pricing strategies to navigate complexities such as exchange rate fluctuations, cultural differences, and variations in purchasing power across regions. By grounding the discussion in theoretical frameworks and empirical evidence, this paper provides a comprehensive perspective on the role of pricing in achieving competitive advantage.

A key component of this analysis is a case study focusing on Tesla, Inc., a globally recognized leader in the electric vehicle (EV) industry. Tesla's innovative approach to pricing exemplifies how companies can align pricing strategies with broader corporate goals, such as sustainability, innovation, and market expansion. By tailoring its pricing models to reflect regional economic conditions, consumer preferences, and competitive landscapes, Tesla has successfully established itself as a dominant player in the global EV market.

This paper's contribution lies in its synthesis of theoretical and practical insights, offering a roadmap for companies seeking to refine their pricing strategies in a globally competitive environment. By examining the interplay between pricing and market dynamics, the research

underscores the importance of strategic flexibility, customer-centricity, and data-driven decision-making in pricing policy formulation.

As globalization continues to intensify competition and economic uncertainty, this study aims to equip businesses and academics with actionable knowledge to navigate these challenges effectively. Pricing, as the research illustrates, is not merely a transactional mechanism but a strategic lever capable of driving sustained growth and differentiation in the global marketplace.

2. Theoretical background

The concept of pricing policy is deeply rooted in economic theory and strategic management, serving as a fundamental element in the formulation of competitive strategies. Pricing policies dictate how a company sets and adjusts its prices to achieve specific objectives, ranging from market entry and profit maximization to brand differentiation and customer loyalty. In the context of global competition, these objectives are further complicated by diverse factors such as international market dynamics, cultural variations, regulatory constraints, and currency fluctuations.

2.1. Key Pricing Models and Strategies

Pricing strategies can be broadly classified into several categories, each with distinct implications for market positioning and revenue generation:

1. **Cost-Plus Pricing:** This traditional method involves calculating production costs and adding a markup to determine the selling price. While straightforward, it often disregards market demand and competitor pricing, limiting its effectiveness in competitive global markets (Kotler & Keller, 2016).
2. **Value-Based Pricing:** A customer-centric approach that sets prices based on the perceived value of a product or service. This strategy aligns closely with branding and differentiation efforts, making it particularly relevant in premium and niche markets (Nagle et al., 2017).
3. **Penetration Pricing:** Employed to gain rapid market share, this strategy involves setting low initial prices to attract customers. It is commonly used during product launches or market entries, though it risks eroding long-term profitability if not carefully managed.
4. **Dynamic Pricing:** A data-driven approach that adjusts prices in real-time based on factors such as demand fluctuations, competitor behavior, and inventory levels. Popularized by e-commerce platforms, leverages advancements in artificial intelligence and analytics to adjust prices in real-time based on demand and competitor behavior (Shapiro, 2020; Brynjolfsson et al., 2021)

2.2. Theoretical Foundations

Economic theory provides a robust framework for understanding pricing policies. Concepts such as **price elasticity of demand**, which measures consumer responsiveness to price changes, play a critical role in determining optimal pricing strategies. A product with inelastic demand, for example, allows for higher pricing without significantly affecting sales volume, a characteristic often leveraged in luxury markets.

Similarly, **game theory** offers insights into competitive pricing dynamics, particularly in oligopolistic markets where a few dominant players influence pricing decisions. The Nash Equilibrium, a key concept in game theory, suggests that companies must anticipate competitors' reactions to pricing changes, thereby fostering a strategic interdependence.

Pricing in Global Markets

Operating in global markets introduces additional complexities to pricing policy. Companies must consider factors such as:

- **Currency Exchange Rates:** Fluctuations in exchange rates can significantly impact pricing strategies, especially for exports and imports. Strategies such as hedging are often employed to mitigate risks.
- **Cultural Sensitivities:** Cultural perceptions of value and affordability influence pricing decisions. For instance, luxury goods may command higher premiums in markets that prioritize status symbols.

- **Regulatory Frameworks:** Tariffs, taxes, and price controls vary widely across regions, necessitating localized pricing strategies.

2.3. Technological Influences on Pricing

The digital era has revolutionized pricing strategies by enabling companies to harness vast amounts of data for predictive modeling and real-time adjustments (Brynjolfsson & McAfee, 2014). Technologies such as machine learning and blockchain have further enhanced pricing transparency and efficiency, optimizing revenue through tailored approaches to customer segments and purchasing patterns (Chen et al., 2019; Kumar, 2021).

2.4. Pricing and Competitive Advantage

The strategic alignment of pricing policies with overall business objectives is critical to sustaining competitive advantage. Companies like Tesla exemplify this alignment by leveraging pricing not only as a revenue driver but also as a brand-building tool. Tesla's pricing strategies, which include premium pricing for early adopters and localized adjustments for global markets, reflect a keen understanding of customer value perception and market dynamics.

In summary, the theoretical underpinnings of pricing policies provide a comprehensive framework for addressing the challenges and opportunities of global competition. By integrating economic principles, strategic management insights, and technological advancements, businesses can craft pricing strategies that enhance their competitive positioning and profitability.

3. Research methodology

This section outlines the research methodology used to analyze the role of pricing policy as a strategic tool in global competition, with a focus on Tesla, Inc. as the case study. The methodology integrates qualitative and quantitative approaches to provide a robust and multidimensional understanding of the subject.

3.1. Data Collection Methods

To ensure comprehensive coverage, data were collected from multiple sources:

1. **Secondary Data:**
 - **Industry Reports:** Analysis of market research and reports from entities such as McKinsey, Deloitte, and Bloomberg, providing insights into pricing trends and competitive dynamics.
 - **Tesla's Financial Statements:** Examination of Tesla's annual reports and investor presentations to identify pricing-related decisions and their impact on revenue and market share.
 - **Academic Literature:** Review of existing research on pricing strategies and economic theories relevant to global markets.
2. **Primary Data:**
 - **Interviews:** Informal interviews were conducted with industry experts and analysts specializing in the automotive and technology sectors. Their insights helped contextualize Tesla's pricing strategies within broader market dynamics.
 - **Market Observations:** Observational data were gathered from Tesla's pricing announcements, regional variations, and promotional campaigns.
3. **Quantitative Data:**
 - Pricing data were analyzed to evaluate trends such as regional price variations, adjustments over time, and correlations with sales performance.
 - Exchange rate fluctuations and their impact on Tesla's pricing strategy in different markets were examined using financial data.

3.2. Analytical Framework

The analytical framework combines qualitative and quantitative techniques:

1. **Content Analysis:** Used to identify recurring themes and patterns in Tesla's pricing strategies. This approach facilitated the synthesis of data from various sources into coherent insights.

2. **Comparative Analysis:** Tesla's pricing policies were compared across different regions to assess localization strategies and adaptations to regulatory or cultural factors.
3. **Economic Modeling:** Key economic concepts, such as price elasticity of demand, were applied to evaluate Tesla's pricing decisions. This included analyzing how changes in pricing influenced customer demand and competitive positioning.
4. **Trend Analysis:** Historical pricing trends were mapped to identify strategic adjustments and their alignment with market developments, such as the introduction of new competitors or regulatory changes.

Tesla, Inc. was chosen as the case study for several reasons:

1. **Pioneering Approach:** Tesla's pricing strategies reflect an innovative approach to balancing premium branding with affordability for mass-market products.
2. **Global Presence:** Tesla operates in diverse markets, each with unique economic, cultural, and regulatory characteristics, making it an ideal candidate for studying global pricing policies.
3. **Dynamic Pricing Adjustments:** Tesla's frequent pricing changes, driven by cost fluctuations, currency exchange rates, and competitive pressures, offer valuable insights into real-time pricing strategies.

4. Findings

Tesla adopts a multifaceted approach to pricing, incorporating value-based pricing, dynamic adjustments, and regional customization.

1. Value-Based Pricing

Tesla's pricing reflects the perceived value of its advanced technology, innovation, and sustainability. For example, the Tesla Model S targets a luxury segment, with prices starting at approximately \$75,000 in the United States. This premium pricing is justified by Tesla's differentiation as a technology leader in the electric vehicle (EV) market.

2. Dynamic Adjustments

Tesla frequently adjusts prices in response to external factors such as raw material costs and competitive pressures. For example, in 2023, Tesla reduced the price of its Model Y in China by over 10%, from ¥288,000 to ¥259,900, boosting its sales significantly (Tesla, Inc., 2023; Bloomberg, 2023). Similarly, its localized pricing strategies account for regional economic conditions and regulatory environments, such as leveraging European subsidies to maintain competitive pricing (McKinsey & Company, 2022; Deloitte, 2021).

3. Localized Pricing

Tesla tailors its pricing strategies based on regional economic conditions, customer preferences, and regulatory environments. For instance, Tesla maintains competitive pricing in Europe, leveraging subsidies and accounting for currency fluctuations, while delaying market entry in India due to prohibitive import tariffs.

4.1. Regional Analysis: Pricing and Performance

Tesla's pricing strategies vary across regions to address local challenges and opportunities.

Table no.1, Tesla's pricing strategy

Region	Model	Initial Price (USD)	Adjustments	Drivers	Outcome
United States	Model 3	\$39,990	Adjusted for federal credits	Federal tax incentives, inflation	Increased affordability for consumers
China	Model Y	¥288,000 (2022)	Reduced to ¥259,900 (2023)	Intense competition, local subsidies	Boosted market share by 15%
Europe	Model S	€86,990	Stable with minor variations	Strong luxury segment, currency trends	Sustained premium brand positioning
India (proposed)	Model 3	Projected: \$70,000	Entry delayed due to tariffs	High import taxes, lack of subsidies	Market entry postponed

Sources: Regional pricing data, Tesla's market reports (2021-2023)

4.2. Case Study: Tesla in China

China is Tesla's most prominent international market, contributing 25% of its global revenue in 2022. Tesla's pricing strategies in China exemplify its agility in responding to competitive and regulatory dynamics.

1. **Localized Adjustments:** To compete with domestic EV manufacturers such as BYD and NIO, Tesla implemented multiple price cuts for the Model 3 and Model Y. This resulted in increased sales volumes, with Tesla delivering over 710,000 vehicles in China in 2023.
2. **Subsidy Utilization:** Tesla leveraged government subsidies, which provided up to ¥25,000 for eligible EVs, reducing the effective cost for consumers.

The following table shows Tesla's sales volume in China relative to its pricing adjustments:

Table no. 2, Tesla's sales volume in China

Year	Model	Price (¥)	Subsidy (¥)	Net Price (¥)	Sales Volume
2021	Model 3	299,900	25,000	274,900	500,000
2022	Model 3	288,000	20,000	268,000	620,000
2023	Model Y	259,900	15,000	244,900	710,000

Source: Author's contribution

4.3. Dynamic Pricing Impact

Tesla's dynamic pricing strategy enhances its responsiveness to external shocks such as currency fluctuations and raw material costs. Below is a breakdown of Tesla's estimated profit margin impact due to price adjustments in key regions:

Table no. 3. Tesla's price adjustments' impact on profit margin

Region	Price Reduction	Cost of Raw Materials (USD)	Impact on Margin (%)
United States	\$2,000	+5%	-3.0%
China	¥28,100	+8%	-2.5%
Europe	€1,500	+3%	-1.0%

Source: Author's contribution

These adjustments demonstrate Tesla's ability to balance competitive pricing with margin sustainability.

4.4. Broader Implications

Tesla's pricing strategies are a testament to the effectiveness of aligning pricing policies with corporate objectives. Key outcomes include:

1. **Increased Market Share:** Dynamic pricing enabled Tesla to maintain leadership in the competitive Chinese market.
2. **Brand Positioning:** Tesla's value-based pricing reinforces its image as a premium, innovative brand.
3. **Adaptation to External Factors:** Localized strategies mitigate risks associated with tariffs, subsidies, and market competition.

5. Conclusions

This study highlights the pivotal role of pricing policy in establishing and sustaining competitive advantages in the global market. Tesla, Inc. stands out as a prime example of how innovative pricing strategies can align with corporate goals to drive success. The analysis reveals that Tesla's approach to pricing is multifaceted, involving value-based strategies, dynamic adjustments, and localization to cater to diverse regional markets.

Tesla's reliance on value-based pricing demonstrates its commitment to leveraging brand reputation and product innovation. By presenting its electric vehicles as premium products, Tesla justifies its higher price points while maintaining a strong connection with customers who value advanced technology and environmental sustainability (Nagle et al., 2017). This strategy not only reinforces its image as a premium, innovative brand but also strengthens its global positioning as a leader in the EV market, allowing it to command a loyal customer base despite intense competition.

Dynamic pricing has further enabled Tesla to respond swiftly to external market pressures, such as fluctuations in raw material costs or competitive pricing from rival manufacturers. For example, the company's price reductions in China between 2021 and 2023 reflect its agility in maintaining sales momentum in the face of growing competition from domestic EV producers like BYD and NIO. These adjustments were not limited to a single market but were part of a broader effort to balance affordability and profitability, particularly as Tesla expanded its presence in multiple regions. By adopting this responsive pricing model, Tesla has demonstrated how aligning pricing policies with real-time market dynamics is essential for maintaining competitiveness in key regions (Porter, 2008; Johnson & Lee, 2021).

Localization has been another cornerstone of Tesla's strategy. By tailoring prices to reflect regional purchasing power, government incentives, and economic conditions, Tesla ensures that its vehicles remain competitive without undermining its premium brand image. For instance, Tesla delayed entering the Indian market due to prohibitive import tariffs, a calculated move that reflects its unwillingness to compromise profitability or affordability for its target customers.

The broader implications of Tesla's pricing strategies point to the necessity of aligning pricing with corporate objectives and market realities. Companies operating in global markets must adopt flexible and data-driven approaches to pricing, ensuring that they can adapt to local conditions while pursuing long-term goals. Tesla's experience underscores the importance of understanding customer perceptions, regulatory environments, and competitive dynamics, which are essential to crafting effective pricing policies.

In conclusion, pricing policy is not merely a tool for revenue generation but a strategic lever that shapes brand identity, customer loyalty, and competitive positioning. Tesla's success exemplifies how businesses can harness pricing as a dynamic, value-based, and localized strategy to thrive in an increasingly complex and competitive global market.

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An Overview over Value Added Tax Gap in the European Union

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Abstract

Value Added Tax (VAT) is a common tax to European Union Member States and is one of their main sources of revenue. Currently, in the European Union, the analysis and measurement of the Value Added Tax gap (VAT gap) has become necessary for fiscal administrations as a consequence of the increase in Value Added Tax evasion. In our paper the aim is to briefly present the features of Value Added Tax, the main objective being to analyze the VAT gap at European Union level and within Member States. The debate on the VAT gap is complex because of the impact of fiscal revenue collection on the economy and society. Other objectives are to present the factors influencing the VAT gap, the VAT rates applied in member countries and to examine the impact of the number and level of reduced rates on the VAT gap.

Key words: Value Added Tax, Value Added Tax gap, tax evasion

J.E.L. classification: H24, H25, H29

1. Introduction

The interest in this research topic arises both from the frequent approach of the subject in specialized literature and from the role of Value Added Tax in the formation of the public budgets of the Member States and the European Union budget.

The research undertaken is placed in the current context of the European Union's fiscal policy, where taxation is considered essential for the functioning of the single market. The Treaty on the Functioning of the European Union, at Article 113, provides the harmonization of legislation regarding excise duties, turnover taxes and other indirect taxes. Such harmonization is necessary to ensure the functioning of the single market. One of the directives with a significant impact on European Value Added Tax regulations is Directive 2006/112/EC on the common system of Value Added Tax in the European Union, with subsequent amendments and additions, which has been transposed into Title VII of the Romanian Fiscal Code (Teodorescu et al, 2017, p. 177).

To achieve the mentioned objectives, the following research hypothesis has been developed: a higher number of reduced Value Added Tax rates and a high level of their value lead to an increase in the Value Added Tax gap.

The paper is based on the bibliographical documentation of various regulations and studies on Value Added Tax, the theoretical research being supported by a study on the Value Added Tax gap in the European Union. The study is based on a European Union report published in 2023 by the Center for Social and Economic Research. The report is based on statistical data from 2017-2021. The report also provides estimates for 2022, but only for a few Member States.

2. Theoretical background

Value Added Tax represent an indirect tax, levied on services and goods in direct proportion to their price, regardless of the number of operations in the economic circuit. This means that the real tax burden is visible at every stage of the production and distribution chain.

Value Added Tax is an important source of revenue for Member States' budgets, but it also has the role of strengthening competitiveness at the European Union level (Teodorescu, 2017). As a sales tax with fairly high rates, it is often criticized on both equity and efficiency grounds (Ulbrich, 2011, pp. 228-238).

Characteristics of Value Added Tax

- *It is a consumption tax* levied on most traded goods and services;
- *It is levied on the 'value added' of the goods/services* at each stage of production and distribution, being charged when companies registered for Value Added Tax purposes sell the goods to other companies (Business to Business B-2-B) or to the final consumer (Business to Consumer B-2-C) (McCullough, 2019);
- It is a tax that influences the cash-flow for Value Added Tax paying companies, while for a non-Value Added Tax paying company it is a cost item.
- As an indirect tax, the Value Added Tax is subject to the phenomenon of repercussion, which occurs when the legal taxpayer enters into economic relations with other taxpayers, on whom the tax burden is shifted.

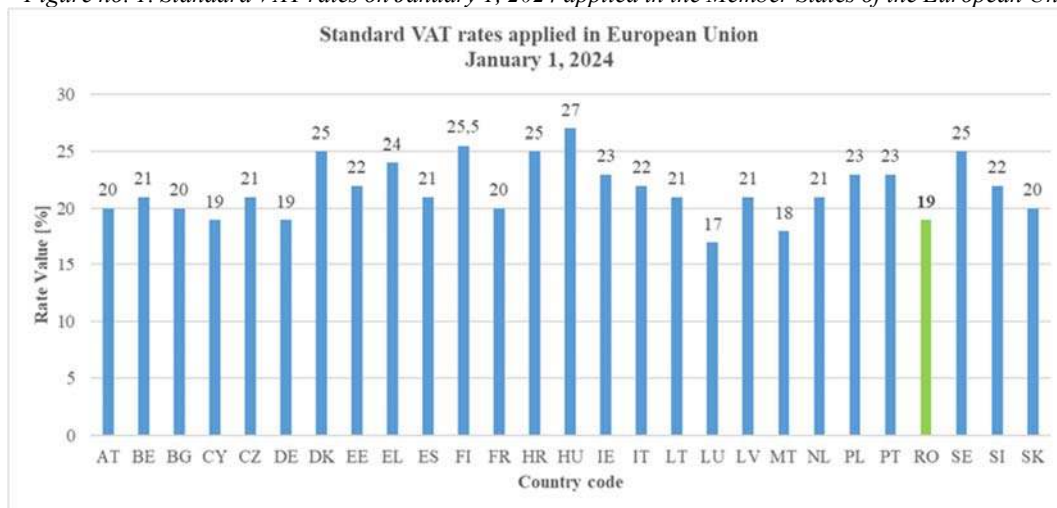
Advantages of Value Added Tax

- *It is a slightly adaptable tax*, which can be decreased/increased according to the needs of the state budget by changing the tax rate (Cernuşca, 2021);
- *It is a tax with a high fiscal yield* (Costea, 2018, p.104) due to the fact that it is applied to a large number of goods and services and is paid by all persons who carry out taxable transactions, without involving high collection costs;
- *It ensures fiscal neutrality in intra-Community trade*, as equal fiscal treatment is applied to both domestically produced goods and goods purchased from other Member States (Teodorescu, 2017).

Disadvantages of Value Added Tax

- *It affects the real incomes of final consumers*, due to the decrease in their purchasing power, as the real burden of Value Added Tax is on the final consumer;
- *It has a regressive character*, mainly affecting people with low incomes;
- *It creates fiscal unfairness* by not taking into account the payer's personal situation, wealth or income.

Figure no. 1. Standard VAT rates on January 1, 2024 applied in the Member States of the European Union



Source: (**Your Europe, 2024)

Value Added Tax rates in the Member States

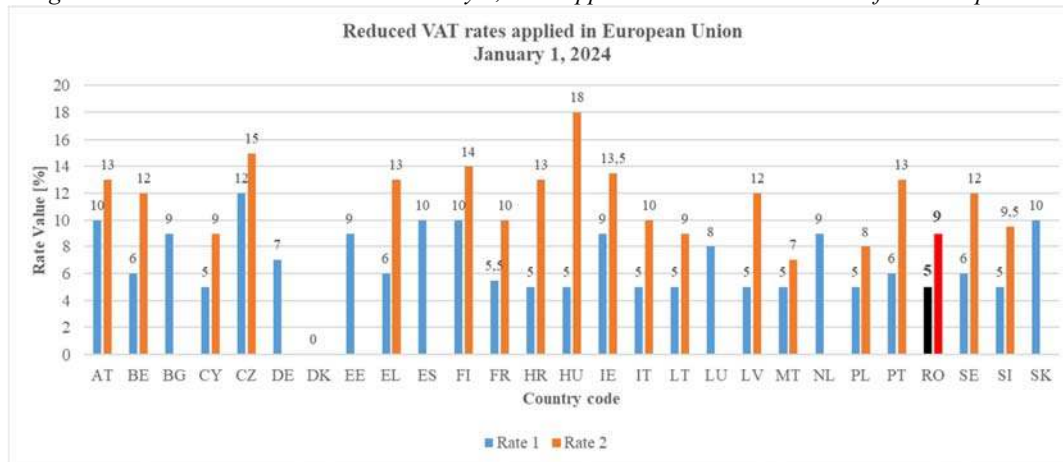
Each Member State of the European Union has a standard rate. This must be greater than or equal to 15% (Figure no. 1) and applies to most services and goods.

In addition there may be one or two reduced rates which may be applied to supplies of specific services and goods and which must be greater than or equal to 5% (Figure no. 2).

Increasing the standard VAT rate has been one of the main ways of meeting increased revenue needs in Member States since the start of the economic crisis in 2008 (Keen, 2013).

Even though successive regulations have established a common system applicable to Value Added Tax, at the level of the Member States, there are still significant differences at the level of tax rates (Figure no. 1 and Figure no. 2). In this regard, it can be argued that the desire for tax harmonization up to the level of closeness or unification of tax rates has not been achieved, the impact of the number of reduced rates and a standard rate influence the efficiency of VAT collection (Kowal et al, 2021).

Figure no. 2. Reduced VAT rates on January 1, 2024 applied in the Member States of the European Union



Source: (**Your Europe, 2024)

In the case of the reduced rate with a value of zero (Denmark - Figure no. 2) the buyer does not pay Value Added Tax. However, the seller is entitled to deduct the Value Added Tax he has paid on purchases strictly related to that sale.

Some Member States are allowed to apply super-low VAT rates of less than 5% for certain goods and services (France: 2.1%, Italy: 4%, Luxembourg: 3%), while others apply intermediary rates for certain supplies of services and goods not included in Annex III of Directive 2006/112/EC (parking rates). For these supplies, countries such as Austria (13%), Belgium (12%), Luxembourg (14%), Malta (12%) and Portugal (13%) continue to apply reduced VAT rates, but no lower than 12%.

The analysis of the data related to Figures no. 1 and no. 2 reveals that although Value Added Tax is the most widely harmonized tax in the European Union, the current Value Added Tax system is a transitional system, still fragmented and complex, as it has not been possible to establish a definitive system that would work in the union in the same way as it would work in a single country (Teodorescu, 2017)

Methods of Value Added Tax fraud at European Union level

Tax evasion, as a phenomenon, occurs both internationally and nationally.

The most common methods of Value Added Tax fraud at European Union level are:

- Missing trader intra-community fraud (MTIC) involving a ghost company. The MTIC fraud pattern is based on sophisticated activities aimed at exploiting differences in the fiscal treatment of Value Added Tax in different Member States.
- The carousel method can involve several firms located in different European Union countries trading the same goods successively, sometimes the goods get to return to the original supplier, the scheme repeating itself.

The VAT gap concept and its influencing factors

The VAT gap concept

The VAT gap is calculated as the difference between the amount of Value Added Tax actually collected and the VAT Total Tax Liability (VTTL) in a situation of full fiscal compliance (Trandafir, 2016).

The VAT gap provides an estimate of the loss of Value Added Tax receipts due to tax evasion, insolvencies, fraudulent bankruptcies and miscalculations. Other circumstances with a significant impact on the size of the Value Added Tax deficit include economic developments, government support measures and the quality of national statistics (Poniatowski et al, 2023).

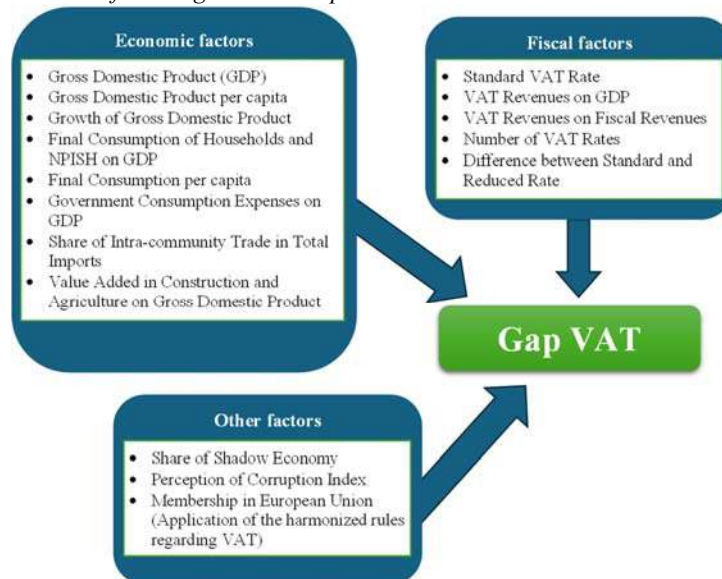
Value Added Tax revenue losses have a negative impact on the expenditure that governments allocate to public goods and services (Ciobanu et al, 2022, p. 34).

Influencing factors of the VAT gap

Understanding the influencing factors of the VAT gap (Figure no. 3) can help reduce the VAT gap by adjusting the Value Added Tax policy (Ciobanu et al, 2022, p. 34).

The determinants of the VAT gap range from legal exploitation of flaws in tax systems to large-scale organized tax evasion.

Figure no. 3. Factors influencing the VAT Gap



Source: (Zídková et al, 2016)

Note: *Adapted from What Causes the VAT Gap?. ** NPISH - Non-Profit Institutions Serving Households.

3. Research methodology

For the assessment of the VAT gap the study uses a scenario based on three working hypotheses: no tax evasion; no reduced VAT rates; no exemptions.

The study takes as its starting point a European Union report on VAT gap and is based on a comparative analysis of VAT gap in the European Union member countries.

Concepts used in the case study

VAT Total Tax Liability (VTTL) – represents the theoretical Value Added Tax revenue in a situation of full fiscal compliance.

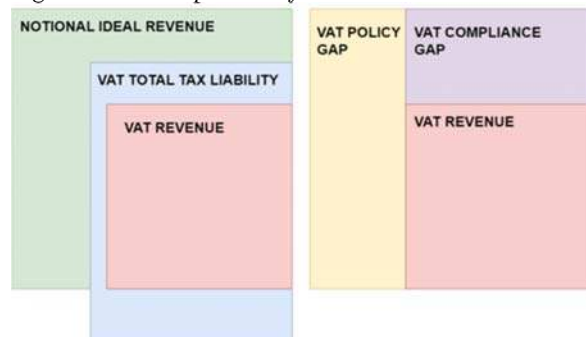
VAT compliance gap - measures overall Value Added Tax non-compliance which includes in addition to Value Added Tax losses due to tax evasion, losses due to insolvencies, bankruptcies, administrative errors and legal fiscal optimization.

Value Added Tax Revenue – represents the amount actually collected to the budget from Value Added Tax.

Notional Ideal Revenue (Figure no. 4) – represent the Value Added Tax revenue that Member States can collect under ideal conditions by applying the standard VAT rate to all goods and services, disregarding reduced VAT rates; it assumes that Value Added Tax is levied on all final consumption of households, government and non-governmental organizations, considering the standard VAT rate.

VAT Policy Gap - is an indicator that measures the additional Value Added Tax revenues that could theoretically be achieved (assuming perfect fiscal compliance in the absence of reduced rates and by applying a uniform VAT rate).

Figure no. 4. Components of the Notional Ideal Revenue



Source: (Poniatowski et al, 2023)

In the methodology used Value Added Tax revenue is the actual revenue received which is compared with a Value Added Tax revenue calculated in the ideal way.

The VAT gap is the estimated overall difference between the theoretical revenue expected to be collected and the amount actually collected. The estimated amount of Value Added Tax that can be theoretical collected is calculated based on the Value Added Tax legislation.

$$\text{VAT gap} = \text{VTTL} - \text{VAT revenue}$$

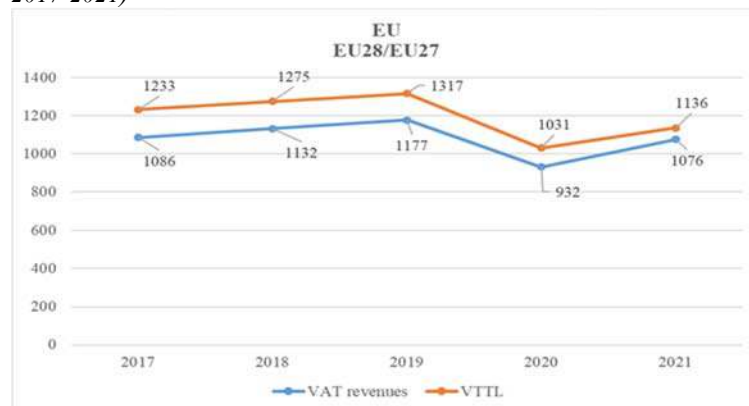
$$\text{VAT gap (\%)} = \frac{\text{VTTL} - \text{VAT revenue}}{\text{VTTL}} \times 100$$

The revenues included in the calculations are based on the European System of Accounts (ESA 2010) and are recorded on an accrual basis.

4. Findings

As shown in Figure no. 5, total revenues from Value Added Tax and VAT Total Tax Liability (VTTL) revenues increased in all years of the period under analysis, except in 2020, when both fell below the levels recorded in 2017 (-14.2%, -16.4%).

Figure no. 5. Evolution of VAT Total Tax Liability (VTTL) and VAT revenues in the EU (EUR billion, 2017-2021)



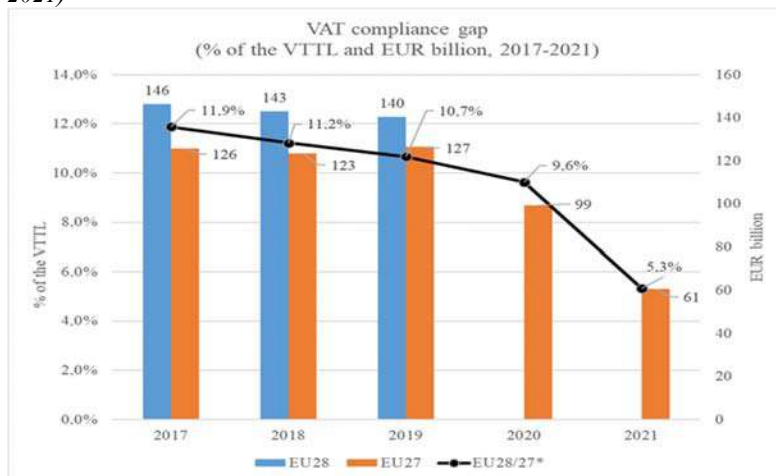
Source: (Poniatowski et al, 2023).

In the 2017-2019 period % of the VTTL has been calculated for EU28 and in the 2020-2021 period for EU27.

In 2021, total Value Added Tax revenues and VAT Total Tax Liability (VTTL) revenues recovered the decline and exceeded the values recorded before the COVID-19 pandemic (+15.5%, +10.2%).

Value Added Tax compliance gap refers to voluntary Value Added Tax compliance and the degree of compliance. If compliance conditions were uniform, the Value Added Tax compliance gap would not exist.

Figure no. 6. VAT compliance gap - evolution in the EU-27/ EU-28 (% of the VTTL and EUR billion, 2017-2021)



Source: (Poniatowski et al, 2023)

In the 2017-2019 period % of the VTTL has been calculated for EU28 and in the 2020-2021 period for EU27.

The VAT gap recorded at the level of European Union Member States has a very high degree of dispersion, with a downward trend from 11.9% in 2017 to 5.3% in 2021 (Figure no. 6).

Table no. 1. VAT compliance gap as a percent of the VTTL in EU-27 Member States (2020 and 2021)

Member State	2020				2021				VAT gap change (pp)
	VTTL (EUR mln)	VAT Revenues (EUR mln)	VAT gap (EUR mln)	VAT gap (%)	VTTL (EUR mln)	VAT Revenues (EUR mln)	VAT gap (EUR mln)	VAT gap (%)	
BE	33 898	29 282	4 616	13.6	36 834	34 304	2 530	6.9	-6.7
BG	6 076	5 635	442	7.3	7 018	6 671	347	4.9	-2.4
CZ	18 236	16 022	2 214	12.1	19 440	18 078	1 362	7.0	-5.1
DK	32 475	31 073	1 402	4.3	35 398	33 618	1 780	5.0	0.7
DE	234 602	221 562	13 040	5.6	266 845	259 385	7 460	2.8	-2.8
EE	2 599	2 469	130	5.0	2 887	2 847	40	1.4	-3.6
IE	15 770	13 765	2 005	12.7	16 708	15 592	1 116	6.7	-6.0
EL	16 351	12 925	3 426	21.0	18 173	14 942	3 231	17.8	-3.2
ES	73 447	69 435	4 012	5.5	82 912	82 250	662	0.8	-4.7
FR	176 449	161 537	14 912	8.5	194 283	184 731	9 552	4.9	-3.6
HR	6 710	6 322	388	5.8	8 108	7 647	461	5.7	-0.1
IT	126 968	99 669	27 299	21.5	135 580	120 980	14 600	10.8	-10.7
CY	2 164	1 786	378	17.5	2 378	2 182	196	8.3	-9.2
LV	2 790	2 541	251	9.0	3 079	2 854	225	7.3	-1.7
LT	4 929	4 009	920	18.7	5 482	4 688	794	14.5	-4.2

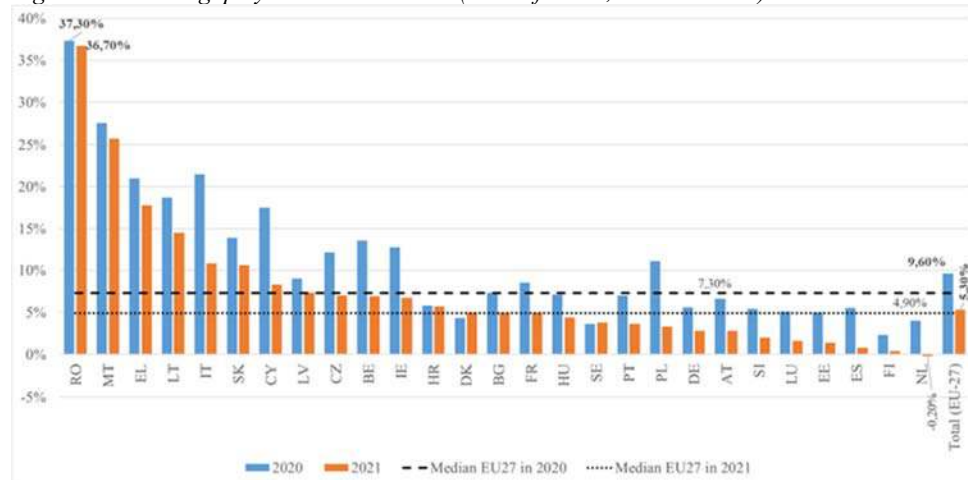
	2020				2021				
Member State	VTTL (EUR mln)	VAT Revenues (EUR mln)	VAT gap (EUR mln)	VAT gap (%)	VTTL (EUR mln)	VAT Revenues (EUR mln)	VAT gap (EUR mln)	VAT gap (%)	VAT gap change (pp)
LU	3 941	3 741	200	5.1	4 414	4 344	70	1.6	-3.5
HU	14 460	13 429	1 031	7.1	15 938	15 230	708	4.4	-2.7
MT	1 171	849	322	27.5	1 346	1 001	345	25.7	-1.8
NL	61 407	58 971	2 436	4.0	65 254	65 400	- 146	-0.2	-4.2
AT	30 133	28 136	1 997	6.6	31 551	30 668	883	2.8	-3.8
PL	47 085	41 856	5 229	11.1	51 010	49 317	1 693	3.3	-7.8
PT	18 071	16 804	1 267	7.0	19 821	19 108	713	3.6	-3.4
RO	21 304	13 368	7 936	37.3	24 507	15 511	8 996	36.7	-0.6
SI	3 754	3 553	201	5.4	4 386	4 299	87	2.0	-3.4
SK	7 925	6 820	1 105	13.9	8 236	7 366	870	10.6	-3.3
FI	22 527	22 005	522	2.3	23 641	23 551	90	0.4	-1.9
SE	45 625	43 981	1 644	3.6	51 151	49 215	1 936	3.8	0.2
Total (EU-27)	1 030 868	931 545	99 323	9.6	1 136 381	1 075 778	60 603	5.3	-4.3
Median (EU-27)				7.30				4.90	

Source: (Poniatowski et al, 2023)

A country-by-country analysis of the VAT gap over the period 2020-2021 shows that the VAT gap has decreased in all European Union countries except Sweden (0.2 pp) and Denmark (0.7 pp), where it has increased. The biggest decreases were seen in Cyprus (-9.2 pp), Italy (-10.7 pp), Belgium (-6.7 pp), Ireland (-6.0 pp) and Poland (-7.8 pp). The changes in the VAT gap for most Member States ranged between 0 and 10 percent of VTTL (Table 1).

In 2021 the highest value of the VAT gap was seen in Romania (36.7%), followed by Malta (25.7%), Greece (17.8%) and Lithuania (14.5%), while the lowest values were recorded in the Netherlands (-0.2%), Finland (0.4%), Spain (0.8%), all below 1% (Table no. 1).

Figure no. 7. VAT gap by EU Member State (as % of VTTL, 2020 vs. 2021)



Source: (Poniatowski et al, 2023)

Data for the graphical representation has been taken from Table 1.

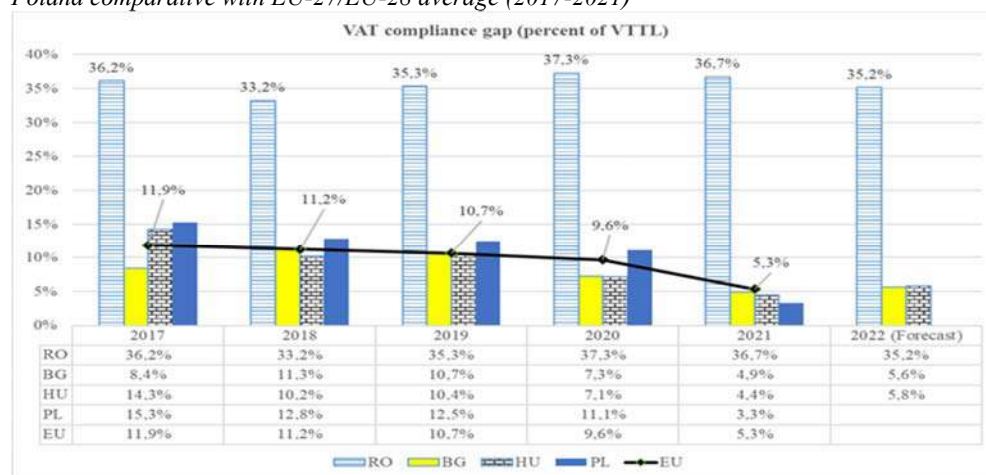
At the European Union level, the share of the VAT gap in VTTL decreased from 9.6% in 2020 to 5.3% in 2021, with the European Union median reaching 4.9% in 2021 from 7.3% in 2020 (Figure no. 7).

The median Value Added Tax-gap value of 4.9% in 2021 is closer to the VAT gap share in VTTL (5.3%) at EU 27 level, showing some degree of convergence of Member States with larger differences in Value Added Tax compliance.

Comparative analysis of VAT gap (as a share of VTTL) in Romania, Bulgaria, Hungary and Poland, in the period 2017-2022

The data presented in Figure no. 8 shows that at the European Union level the VAT gap trend has been downward, from 11.9% in 2017 to 5.3% in 2021. The same trend was recorded in Poland, from 15.3% in 2017 to 3.33% in 2021 (Figure no. 8). In Hungary and Bulgaria the trend has been random, with decreasing trends starting from 2018 in the case of Bulgaria and 2019 in the case of Hungary, with the mention that in the 2019-2021 period, both countries have recorded VAT gap values lower or equal to the European Union average. Estimated data for 2022 show an increase in the VAT gap for both Hungary and Bulgaria.

Figure no. 8. Evolution of the VAT compliance gap (% of the VTTL) in Romania, Bulgaria, Hungary, Poland comparative with EU-27/EU-28 average (2017-2021)



Source: (Poniatowski et al, 2023)

Note: * In the 2017-2019 period % of the VTTL has been calculated for EU28 and in the 2020-2022 period for EU27. ** Data for 2022 is partial and estimated.

Policy gap in European Union

In order to understand how the different elements of the fiscal system contribute to the loss of Value Added Tax revenues, the VAT gap can be broken down into several components: the VAT rate gap and the VAT exemption gap. This breakdown makes it possible to determine the influence of the application of reduced VAT rates and their level, as well as the impact of exemptions or exclusion of a part of the final consumption from the tax base on Value Added Tax revenue.

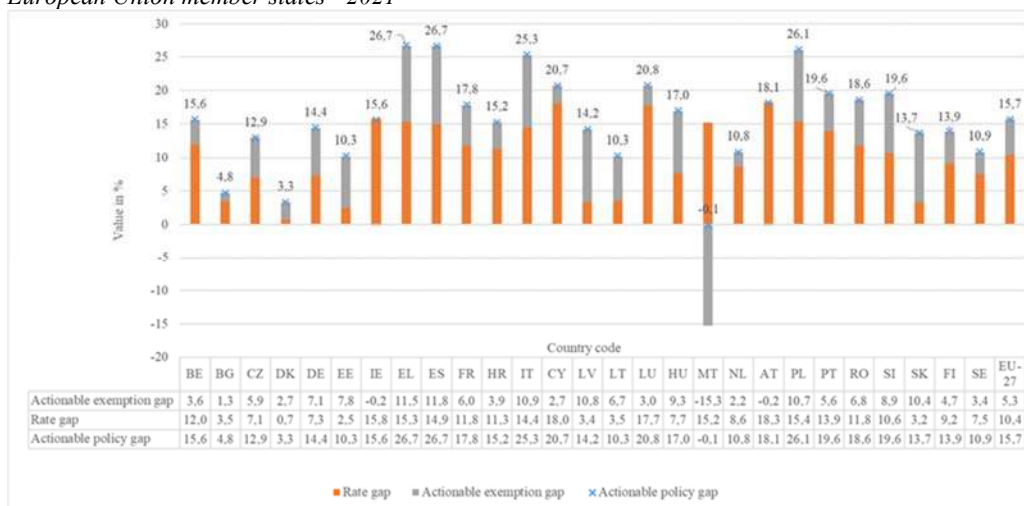
The assessment of the impact of reduced rates, their levels and exemptions on Value Added Tax revenue losses is based on a comparison of the VTTL (VAT Total Tax Liability) and the potential revenue that could be collected in a ideal VAT system with a uniform rate and the widest possible tax base (Notional Ideal Revenue). This VAT policy difference catch the effects of applying multiple tax rates, exclusions and exemptions on the revenue determined theoretical that could be collected under a given Value Added Tax system (Figure no. 9).

Certain exemptions and exclusions apply to goods and services which are difficult to tax (such as goods and services which are not offered at market prices - public services), or for which it is difficult to define the taxable base (insurance and financial services) and the place of supply (in the case of international transport).

The impact of reduced VAT rates is lower in countries that rely either on a single reduced rate, e.g. Slovakia (3.2%), Estonia (2.5%), Bulgaria (3.5%), Denmark (0.7%), or on lower rates, e.g. Lithuania (3.5%) and Latvia (3.4%).

The multiple reduced rates (Figure no. 9) have led to significant losses of Value Added Tax revenue in countries such as Austria (18.3%), Cyprus (18.0%), Ireland (15.8%), Poland (15.4%), Greece (15.3%), Malta (15.2%), Romania (11.8%). But there are also countries where the existence of several reduced rates has not led to significant revenue losses, such as the Czech Republic (7.1%), Sweden (7.5%), Finland (9.2%).

Figure no. 9 Actionable policy gap split into the actionable exemption gap and VAT rate gap and the in European Union member states - 2021



Source: (Poniatowski et al, 2023).

At European Union Member State level, there were significant losses of Value Added Tax revenue due to exemptions (Figure no. 9) in countries such as Spain (11.8%), Greece (11.5%), Italy (10.9%), Latvia (10.8%), Poland (10.7%), Slovakia (10.4%).

5. Conclusions

Value Added Tax gap monitoring is very important because:

- Value Added Tax not only contributes to national budgets, it is also a source of revenue for the European Union budget.
- It serves as an indicator of national fiscal administrations' performance in collecting Value Added Tax.
- The lost revenue from Value Added Tax has a negative impact on government expenditure.
- Estimating the size of the Value Added Tax shortfall contributes to the development of measures to improve Value Added Tax collection.

Among the factors with a major influence on the VAT gap, the most important is related to the fiscal features of the Value Added Tax system. Starting from the fact that both reduced rates and exemptions are important fiscal policy instruments that encourage certain areas of activity and protect vulnerable social groups, it is recommended to implement them carefully in terms of their impact on the VAT gap.

The VAT gap is highly dispersed across Member States. Studies show that the positive changes in VAT compliance have been mainly due to the digitization of fiscal administrations, the implementation of e-invoicing and the reduction in the frequency of bankruptcies.

Although there have been significant losses of Value Added Tax revenue in countries such as Austria, Ireland, Cyprus, Poland, Greece, due to the multiple reduced rates, there are also countries where the existence of multiple reduced rates has not led to a significant loss of revenue, for example Sweden and the Czech Republic. The impact of rates on the VAT gap is lower in countries that rely on lower reduced rates less, e.g. Latvia, Lithuania. In this regard, it can be stated that the research hypothesis has been confirmed only in some European countries.

Romania remains at the top of the ranking of countries with a high VAT gap, which highlights a high level of non-compliance and tax evasion. Romania's compliance gap recorded high values over the 2017-2021 period, being the highest in the European Union. The highest value can be seen in 2021, at 37.3%, the highest level in the European Union and significantly above the EU27 average.

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Analyzing the Social Protection and Assistance Expenditure in the Welfare State in Romania

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Abstract

This paper highlights the complex relation between the social protection and assistance expenditure and the gross domestic product (GDP) in Romania, for the period 2007-2022, to show how far the objectives of the welfare state in Romania have been achieved. It promotes the responsibility of the state in ensuring a minimum level of well-being for its citizens through public policies and social programs. The economic changes have directly influenced the allocation of resources for social protection and assistance, while these expenses have affected, in turn, the economic dynamics, reflected by the increase in GDP. The correlation between the social protection and assistance expenditure and the GDP in Romania shows that, in general, the economic growth has allowed the increase of social expenses, and in periods of economic crisis, these expenses have become more necessary to support the well-being of the population.

Key words: correlation, GDP, social assistance expenditure, social protection expenditure, welfare state

J.E.L. classification: E58, E60

1. Introduction

The post-revolutionary Romanian state assumed the duty of ensuring the quality of life for all citizens and concentrated differently over time on social investment, on resource redistribution throughout life and between generations, or on compensating those disadvantaged and disfavored.

The Romanian specialized literature showed that the general efforts made to ensure a decent standard of living for the citizens had an upward trend; the people's needs also recorded a much faster upward trend. Since a large part of the respective studies concerned the period of transition to the market economy, the objective of this paper is to analyze correlation between the social protection and assistance expenditure and the GDP, in the period 2007-2022. The mentioned period was chosen considering that, after Romania's adherence to the European Union, the economy of our country became stable and registered an important growth, compared to other European countries. The increase in the incomes of all social categories is reflected in the significant improvement of the population's standard of living.

This paper includes a review of the specialized literature on the notions of social welfare and the welfare state, as well as an analysis of the evolution of the social protection and assistance expenditures and of the GDP.

The result of this study reveals that, in the period 2007-2022, the increase in social assistance expenditure kept pace with the GDP increase. The social protection expenditure financed from the state social security budget is more strongly correlated with the GDP, compared to the social assistance expenditure financed from the central and local government.

2. Theoretical background

Ensuring the well-being of citizens is a fundamental objective of all modern states. This aspect causes them to be frequently called welfare states. Traditionally, the social welfare activities have focused on income redistribution, establishing criteria for granting additional or replacement incomes to those initially obtained. However, the socio-economic and political fluctuations from the post-war period led to a gradual convergence of income redistribution policies with those regarding initial distribution, with mutual borrowing of criteria regarding the distribution of resources and incomes. As a result, the criteria of economic efficiency, which previously governed the stage of initial distribution, began to be integrated more and more explicitly in the policies related to social equity, which were predominant in the stage of redistribution, and vice versa.

The literature in this field extensively analyzes the concept of social welfare and, in close connection with it, that of the welfare state. As noted by Olsson (1993), the concept of social well-being covers multiple aspects, of political (well-being is part of the manifestation of a political community), social (well-being is perceived as a manifestation of social solidarity) and economic nature (well-being aims to reduce poverty and even eradicate it). According to Cace (2004), various institutions contribute to social welfare in all communities: the family, the civil society, the market and the state. Typologies of welfare distribution and welfare states have been developed over time, focusing mainly on the type and purpose of the responsibility that the state assumes in the field of welfare. Andersen (2012) drew attention to the differences between the residual welfare state, which aims to limit employment only to marginal groups, and the redistributive-institutional state, which addresses the entire population and is universal in terms of state obligations. Korpi, Walter & Joakim Palme (2003) have debated the issue of the achievement-industrial performance model, an intermediate type of welfare state, where welfare needs can be met based on merit, work performance and productivity.

The governments' ideological option in certain periods and the design on this basis of what was defined as a fair distribution of resources in society made the ways in which the objectives of the welfare states were to be put into practice different. One of the most influential works addressing these concepts is "The Three Worlds of Welfare Capitalism" written by Esping-Andersen (1990), in which he introduces the concept of "welfare state regimes". Esping-Andersen identifies three main orientations: liberalism, Christian-democracy and social-democracy, classifying the welfare regimes into: liberal, corporatist and social-democratic (Esping-Andersen, 1990, 1999).

The challenge of maintaining a balance between significant public spending in welfare states, financed by hefty taxes on the one hand, and the competitiveness of attractive investment markets on the other, is a major concern for economists. Many scholars argue that the goal of government policies is to maximize the welfare of the low-skilled at a level that does not attract or confer an excessive advantage over the high-skilled (Hines, 2006; Finseraas, 2009; Rehm et al. 2012; Lunau et al., 2014).

Various points of view have been expressed over time regarding the situation in Romania. Given the transition to the market economy, Zamfir and Zamfir (1995) suggested that our country had to choose between a policy of welfare and one of social survival, that is, between building a society of welfare, focused on the concordance between the community and the individual by investing in human capital, and a social policy approach focused on reducing poverty to build a survival society. Lazăr (2000) argued that the welfare state in Romania was seriously affected by the social, economic and political challenges it faced and pleaded for creating a welfare state specific to the particularities of the Romanian state. Redistribution through public spending is not enough in the process of reducing inequalities. Fiscal policy plays a crucial role in ensuring a fair income distribution of income, in economic stabilization and recovery. A study from 2006 (Deme) revealed that the welfare state in Romania developed with difficulty, responding late to the needs of the population. Schipor and Frecea (2018) and Rat et al. (2019) highlighted the special form of the welfare state in Romania that exists in institutional terms but is not perceived as such by precarious citizens and with limited market capacity, since the real economic progress has not been fully reflected in the level of welfare.

The current challenges of the welfare state in Romania are determined by the risk of poverty and social exclusion (especially among children and people from rural areas), insufficient funding and the low efficiency of spending on social protection and assistance (funding of the social insurance

system is strong affected by the loss of labor generated by migration), significant differences in terms of access to services and the quality of life between the developed and the less developed rural regions and the problem of population aging which puts huge pressure on the pension system and social assistance for elderly (Government of Romania, 2022).

3. Research methodology

This study uses a mix of research methods and techniques to reach the established objectives and draw some final conclusions. The statistical analysis method and computer tools such as Microsoft Excel spreadsheet and SPSS software were applied to centralize, process and analyze the primary data collected from the reports of the Ministry of Finance. We obtained statistical series on social protection expenditure financed from the state social security budget, on the one hand and on social assistance expenditure financed from the central government budget and local government budget, on the other hand and the gross domestic product, for the period 2007-2022. The social protection expenditure includes the redistributive transfers, based on intergenerational solidarity and the principle of contribution (pensions, unemployment allowances, compensation for work accidents, etc.), and the social assistance expenditure includes the redistributive financial benefits for vulnerable individuals or groups, such as social assistance, allowances, allowances for disabled people, support for families and children, etc.

The practical application includes a descriptive statistical analysis, testing the homogeneity and normality of distribution and testing the correlations obtained by calculating the correlation coefficient. The Pearson coefficient is a directional coefficient and can have values between -1 and +1. Values close to +1 indicate the existence of a direct (positive) association between the two variables, while values close to -1 indicate the existence of an inverse (negative) association. The closer the values are to 1 (regardless of sign), the stronger the association, the more "linked" the variables are to each other.

4. Findings

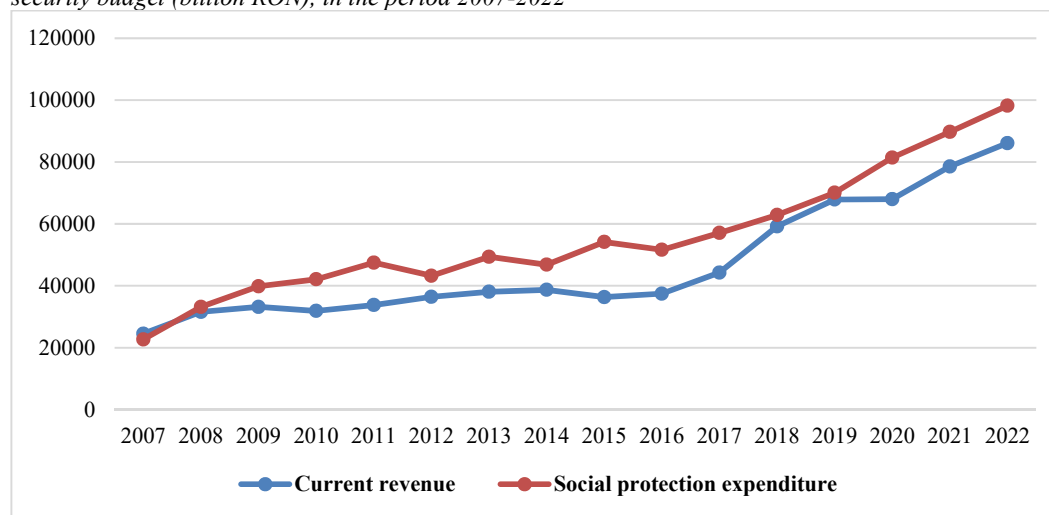
The evolution of social protection and assistance expenditure in Romania was influenced by numerous demographic, economic and political factors.

The social protection expenditure in Romania has generally registered an increasing trend over the last decades, given the increase in the number of pensioners and the implementation of policies to increase pensions. In the 2000s, some significant social security reforms were implemented, including the introduction of Pillar II pensions (privately administered pensions). The global economic crisis of 2008 hit Romania hard, with a major impact on the social security budget, as the pressure on the social protection system increased, with more people relying on social support.

Starting from 2009, the deficit of the social insurance budget, including the special/service pensions, has increased considerably, reaching 20.7 billion RON in 2022 (Figure no. 1). In 2018, it registered a significant decrease, going down to 11.6 billion RON, mainly due to the fiscal measures adopted to reconfigure the taxation system of income from salaries, pensions, self-employment and royalties by transferring contributions from the employer to employed.

Although the total contribution rates decreased, the transfer of contributions from the employer to the employee generated an important increase in the gross salary, causing an increase in the level of taxation through insurance contributions by approximately 13.9%. In addition to the increase in the labor taxation through social insurance contributions, the deficit reduction 2018 was also due to the decrease in the share of contributions to Pillar II of pensions (from 5.1% in 2017 to 3.75% in 2018). In 2019, the social security budget deficit continued its downward trend, reaching 9.7 billion RON, due to the increase in the number of employees in the economy. However, in 2020, the social insurance budget deficit registered an important increase generated by both the increase in pensions and the decline in income, following the recession caused by the pandemic, a trend that continued until 2022.

Figure no. 1. The evolution of the current revenue and the social protection expenditure - state social security budget (billion RON), in the period 2007-2022

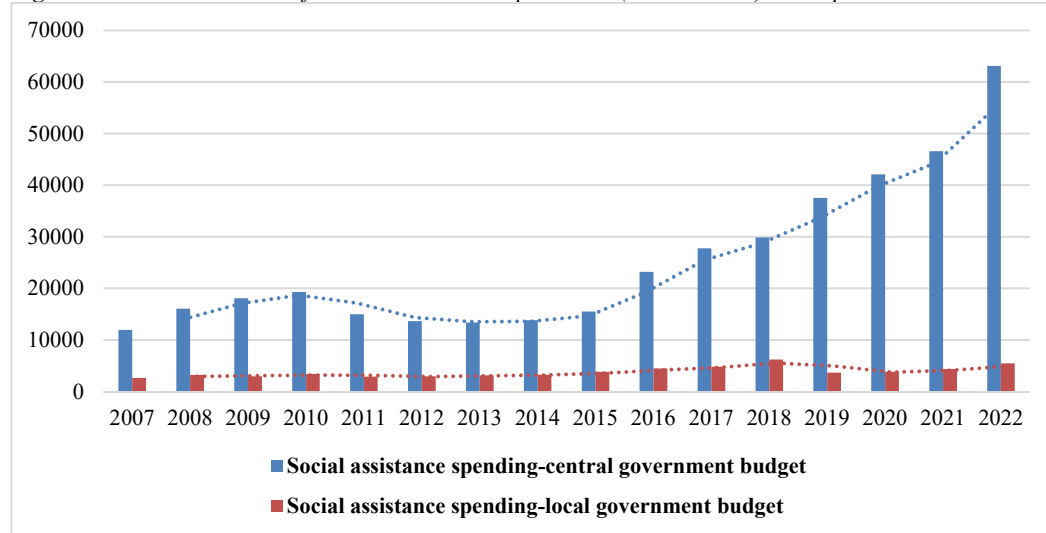


Source: own design based on the data provided by the National Institute of Statistics

The evolution of social assistance expenditures recorded an upward trend in recent years, both in terms of state budget and local budgets (Figure 2). Most of the social assistance expenses are financed from the state budget. The public social assistance services at the local level have a reduced capacity to identify situations of difficulty and/or social vulnerability due to the limited specialized personnel and an insufficient budget allocation.

In the 2000s, Romania implemented a series of reforms to modernize the social assistance system, according to the European Union's requirements for integration, measures to direct support more effectively to the most vulnerable social categories, including the support programs for the children from the disadvantaged families, people with disabilities and the elderly with low incomes. The global economic crisis of 2008 put enormous pressure on the welfare system as more and more people needed support due to unemployment and economic problems. In 2010, the Government implemented some austerity measures, which included the reduction of some social benefits or their restructuring in order to limit budget expenditures. On the other hand, the recovery of the national economy and the trend of economic growth after the global economic crisis reduced the pressure on the social assistance system in Romania. Along with Romania's economic recovery, the social assistance expenditure began to increase again, being directed towards supporting vulnerable categories, such as children from disadvantaged backgrounds, single-parent families, people with disabilities and the elderly. The solid economic growth recorded after 2015 allowed for a sustained increase in social assistance expenses, which were directed towards supporting vulnerable categories, such as children from disadvantaged backgrounds, single-parent families, people with disabilities and the elderly. The COVID-19 pandemic has brought a massive increase in the social assistance expenditure, given the health and economic crisis, by introducing support programs for technical unemployment, aid for economically affected families and support packages for vulnerable people, including the elderly, isolated people or with high social risk.

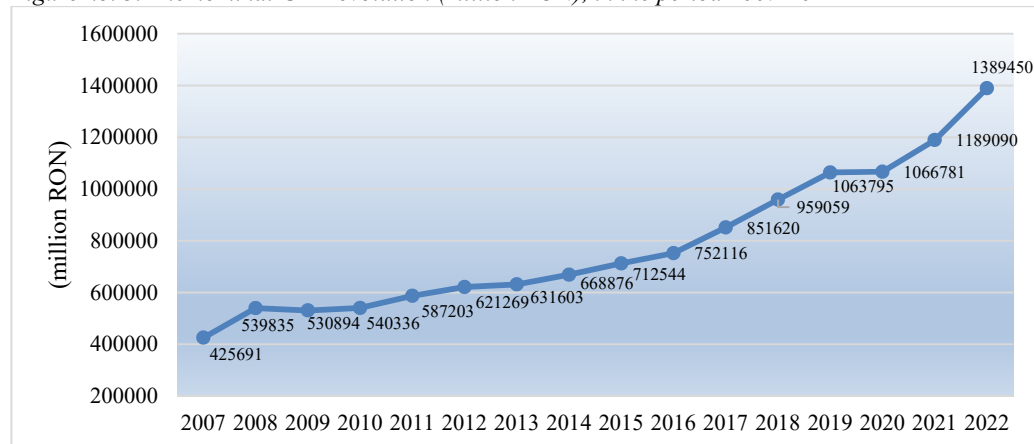
Figure no. 2. The evolution of social assistance expenditure (million RON) in the period 2007-2022



Source: own design based on the data provided by the National Institute of Statistics

Romania's GDP evolution after joining the European Union reflects the economic transformations the country went through, but also the impact of the economic crises of the last two decades. Romania's adherence to the European Union boosted the economic growth through access to the European market, investments and structural funds. The GDP recorded annual growth rates of 6-8% in the period before the global economic crisis of 2008 (Figure 3). The global economic crisis strongly affected Romania's economy, causing a significant drop in the GDP in 2009. The economic recovery began in 2011, but the GDP growth was slow compared to the pre-crisis period. In the period 2015-2019, Romania's GDP increased significantly, recording one of the highest growth rates in the European Union, thanks to the stimulation of domestic consumption and tax reductions. In 2020, the COVID-19 pandemic led to a strong economic contraction, with the GDP falling by more than -3%, due to restrictions. In the following period, the losses were recovered, the GDP growth being stimulated by the reopening of the economy and the governmental support measures.

Figure no. 3. The nominal GDP evolution (million RON), in the period 2007-2022

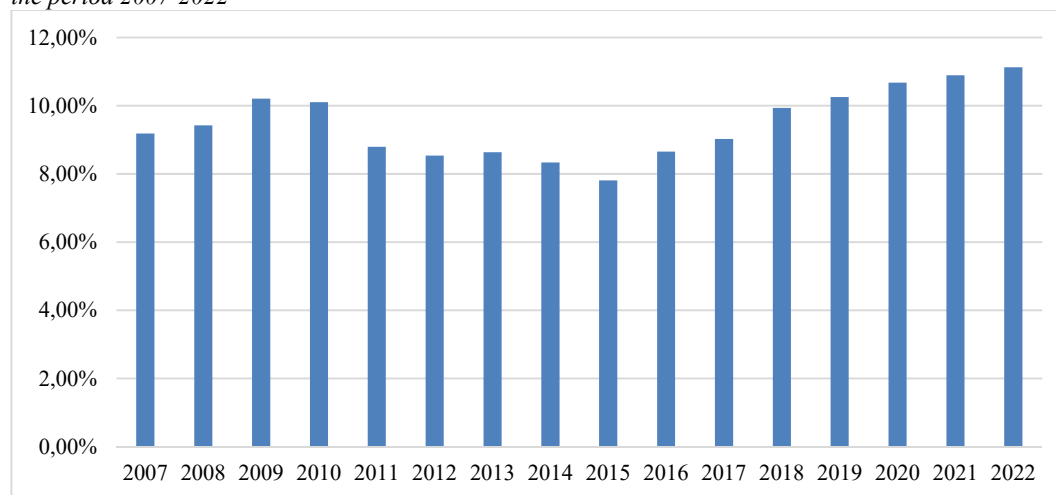


Source: own design based on the data provided by the National Institute of Statistics

The social protection and assistance expenditure in Romania had a significant share in GDP, in the analyzed period, between 8% and 11% of the GDP, depending on the economic and political context (Figure 3). In periods of economic growth, the share of social protection and assistance expenditure in the GDP decreased slightly because the expenses increased less than the economy as

a whole. Conversely, in times of recession, this share tends to increase as the GDP falls and social needs increase.

Figure no. 4. The evolution of the shares of social protection and assistance expenditures in the GDP, in the period 2007-2022



Source: own design and calculations, based on the data provided by the National Institute of Statistics

Table no. 1 shows the specific indicators for the descriptive statistical analysis. For all analyzed variables, the statistical rule is that the average must be well above the standard deviation.

Table no. 1. Descriptive statistics of the data used in the analysis

Indicators	Average	Standard deviation	No
Social protection expenditure -state social security budget	46,621	4,726	16
Social assistance expenditure -central government budget and local government budget	29,249	3,882	16
Gross Domestic Product	783,135	69,022	16

Source: own calculations

The results of the regression analysis are presented in Table no. 2.

Table no. 2. The results of the correlation between the variables included in the analysis

Indicators		Social protection expenditure	Social assistance expenditure	Gross Domestic Product
Pearson correlation	Social protection expenditure-state social security budget	1,000	0.956	0.982
	Social assistance expenditure -central government budget and local government budget	0.956	1,000	0.961
	Gross Domestic Product	0.982	0.961	1,000
Sig. (1-tailed)	Social protection expenditure -state social security budget	0,0	0,227	0,004
	Social assistance expenditure -central government budget and local government budget	0,227	0,0	0,003
	Gross Domestic Product	0,004	0,003	0,0

Source: own calculations

The analysis of the data in the above table reflects a direct, significant correlation between the social assistance expenditure and the GDP. The correlation coefficient reaches 0.982 for the expenditures financed from the state social security budget and 0.961 for the expenditures financed from the central government budget and local government budget, with a sig level below 0.05.

5. Conclusions

From the perspective of ensuring the level of well-being, the priorities of the Romanian state are the fight against poverty and social exclusion. The evolution of social protection expenditure reflects the complexity and challenges of Romania's economy and the need for constant adjustment to maintain a balance between financial sustainability and social needs. Population aging and government policies are major factors that have influenced social protection expenditure in Romania. The evolution of social assistance expenditure was strongly influenced by the economic and political context of the country and reflected the need to protect the most vulnerable groups.

After joining the European Union, Romania has achieved important progress in its economic development, recording an average annual increase in real GDP of over 3%, higher than the EU average, in the last two decades. During periods of sustained economic growth, the Government increased spending on protection and social assistance, having more financial funds available. Social policies and spending increases for protection and social assistance were often used to stimulate domestic consumption, with a positive effect on the GDP growth, given the large share of consumption in Romania's economy.

During the periods of economic recession determined by the global financial crisis of 2008 and the COVID-19 pandemic, Romania registered a decrease in the GDP, accompanied by an increasing demand for protection and social assistance.

In the future, greater attention should be paid to the tendency of excessive growth of expenses for social protection and insurance, because without a sustainable economic growth this tendency can aggravate the budget deficit, with implications on the increase of the public debt and the need to increase the fiscal pressure. At the same time, the way of directing these expenses must be analyzed, because they may not have a significant impact on poverty reduction or lead to the inefficient use of resources, so that the mission of the welfare state in Romania will not achieve its goals.

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Creative Accounting in Financial Reporting

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Abstract

One of the great financial accounting challenges – creative accounting can be investigated from several perspectives: accounting, ethical, legal or psychological. The paper aims to achieve, based on a qualitative analysis, a synthesis over the perception of the creative accounting techniques from an ethical perspective, but also to identify the possible motivations that can be the basis for these techniques use by the managers and the professionals in the financial field. In general, creative accounting is seen as a negative technique, as a method of manipulating financial statements, which can negatively influence, in particular, the decision-making process and, in the long term, even the company itself, but which can be limited by implementing some strict reporting standards, independent audits, ethical education and by the use of innovative technologies. Among the identified motivations, we found the desire of the management to reach the performance standards imposed by the capital holders, obtaining capital under favourable conditions, reducing the tax bases, meeting certain criteria necessary for listing on the stock market, covering some faulty management decisions.

Key words: creative accounting, creative accounting techniques, ethic in accounting, accounting manipulation, creative accounting motivation

J.E.L. classification: M41

1. Introduction

Although accounting continues to represent the main provider of financial-accounting information to companies' stakeholders, and the increase in competitiveness and profitability both domestically and internationally requires accurate, compliant, reliable and standardized reporting (Hýblová et al., 2022), sometimes they are reluctant to report realistically and faithfully (Aygun, 2013), accounting no longer being the mirror of all transactions that companies are carried out. The financial and non-financial statements presentation tends to be influenced by the divergent interests, objectives and professional views, corporate management and equity holders (Drabkova & Martin, 2022).

The numerous financial scandals generated by the use of different creative accounting techniques, keep researchers focused on this subject, in an attempt to determine both the factors that underlie the decision to use them, and the effects that these techniques can have on the company but also on the economic-social situation, as a whole. Motivated by the concern that investors attach to financial results, managers and financial accounting professionals manipulate the numbers in such a way that they reflect the economic situation according to their own interests and less the true image of the company. Despite the negative perception of these manipulation techniques, there are also opinions that support creativity in accounting as a source of innovation within companies. This creativity is perceived as the art of searching for, identifying, adapting and implementing unconventional procedures, innovative ideas and original solutions capable to generate innovation and added value at the organizational level (Vartiak & Garbarova, 2024). The problem of creative accounting is not

limited to the corporate level, but can be analysed at the national level, the European states that joined the Economic and Monetary Union (EMU) used such techniques, or at the regional or governmental level (Goto & Yamamoto, 2023). Among the motivations encountered, one can identify the desire to present improved returns, results in line with the established objectives, the desire to justify certain negative situations.

At the extreme limit of creative accounting is economic crime (Zbigniew, 2019), which assimilates serious accounting errors and fraud with major ramifications, which tends to be more of an economic crime than a tax optimization technique, with significant impact on companies globally. In order to counteract these practices, it becomes impetuously necessary to analyse not only the external variables that settle companies to integrate such techniques, but also the internal variables, capable of explaining the attitude, intention and behaviour of managers and professionals in the face of this phenomenon. Ethics in accounting is the link, the point of balance between the innovation allowed in reporting techniques and the fulfilment of the fundamental principles of business ethics.

The purpose of this study is to identify the way in which managers and accounting professionals currently perceive the creative accounting techniques as well as the possible motivations underlying the adoption and use of such techniques of manipulation and distorted presentation of realities through the lens of ethical issues. The research is established on an empirical investigation study based on a series of semi-structured interviews with managers and professionals from the financial - accounting field of some Romanian companies active in different fields. The work identified a negative perception of the creative accounting techniques of those interviewed, but also a series of motivations that could be the basis of the decision to use them within the companies.

The main objectives are to identify the acceptance of the creative accounting techniques, both on the part of professional accountants and managers in their dual capacity: both users of financial - accounting information but also providers of it, as well as the main motivation that lies at the basis for these technique adoptions. Along the stated logical line, we thus identified two specific objectives:

1. Analyse the perception over the creative accounting techniques
2. Describe the motivation of the pro-creative attitude in accounting under the influence of ethical principles

Based on a critical content analysis, the primary data resulting from the semi-structured interviews were thus processed. The study addresses the acceptance of creative accounting techniques as well as the motivation among professionals and managers that can underlie the use of such tools, being structured in five sections. The introduction brings the motivation and the research questions to the reader attention. In the specialized literature analysis, a theoretical perspective of different researcher opinions who studied the issue of creative accounting is offered, being the theoretical basis on which the research hypotheses were established. Section number three presents the research methodology, the research sample, the limitations of the paper as well as future research directions. In section number four, the results obtained are described in details and the results of similar studies are discussed. The last of the sections highlights the conclusions as well as the research implications.

The originality of the study results from the presentation of new realities regarding the phenomenon of creative accounting from an ethical point of view, but also the motivations that can lead different categories of interested parties to integrate them into current techniques within companies.

2. Theoretical background

Accounting, as a social science, presents multiple facets, being both a science and a technique, but it can also be seen as a historical phenomenon, art, stake or social game (Cernuşca et al., 2016). In the specialized literature, creative accounting practices are presented under various names, the most widespread being earnings management, especially in the USA (Breton & Taffler, 1995; Khatri, 2015), but also engineering financial, fraudulent accounting (Škoda et al., 2017) or bad accounting (Balaciu et al., 2017).

Rahman (Rahman et al., 2023) defines creative accounting in terms of sophisticated accounting skills and practices that are permitted by current regulations. Based on these refined techniques, the company's management presents the reports in a convenient and distorted way. The term creative

accounting tends to be attributed, especially to accounting manipulation techniques involving, in particular, balance sheet elements and less performance indicators presented in the profit and loss account (Škoda et al., 2017). Creative accounting is a tool that bypasses the spirit of standard accounting rules and procedures and allows the permutation of accounting practices (Olojede & Olayinka E., 2021), and which generates challenges for investors to decipher.

This explains the great failures of companies such as Enron Worl.com or Arthur Anderson, which, despite their stability and financial dimensions, have failed due to innovative accounting practices: inadequate financial reporting, the use of financial indicators, lack of ethics, inadequate governance procedures (Rahman et al., 2023 Feleagă & Feleagă, 2006).

In defining creative accounting, the authors make a clear distinction between two practices: fraud aimed at presenting the entity in a favourable manner and changing the equity value by not applying reporting standards (Hýblová et al., 2022), creativity being used either to present in a more attractive manner for investors or to influence, or to distort financial reports, and financial records are treated in an unethical way, at the limit of the legal regulations in force (Feleagă, 1996). Kováčová (2022) identified some of the processes and strategies by which management directs income and reported values are all more varied: valuation of properties, erroneous entries in voluntary mode in accounting, sales handling, earnings management.

Abed (2022) identifies four of the essential creative accounting components: the ownership form, the internal control type, the business ethics level, the reporting quality and Blazek (2023) puts corporate governance as the main obstacle in the spread of creative accounting techniques, considered to be lacking in professional ethics and fairness to interested parties, an exercise of managerial power with the aim of undermining the authority of regulatory bodies in the financial-accounting field.

Due to the lack of coercive measures against these techniques and their worldwide acceptance, creative accounting opens certain loopholes (Gupta & Kumar, 2020) that exist in the regulations and rules that govern the preparation and financial – accounting reporting and can throw very lightly towards tax fraud or economic crimes with a negative impact on economic life, as a whole.

The motivations underlying the adoption of creative levers in accounting are increasingly diverse (Feleagă & Malciu, 2002) and dynamic: the desire for personal gains, results comparability, attractiveness for investors, company capitalization, postponement of payment terms for debts.

The main creative accounting methods identified by researchers include, among others: revenue manipulation – either delaying or accelerating the time of revenue recognition – cost manipulation – either delaying the time of expense recognition or overestimating assets – excessive use of provisions – diminishing liabilities in profitable periods to transfer during difficult periods in terms of results.

The implications and risks associated with these techniques are found both at the micro level, the trust of capital holders, the stability of the financial market, the damage to the company's reputation, but also at the macroeconomic level: negative impact on the financial markets through erroneous decisions by investors, the possibility of massive frauds by companies.

The measures that can be taken to limit and counteract these practices are the prerogative of international regulatory bodies through strict standards and guidelines for financial reporting, tough measures capable of combating financial manipulation. And auditors have a crucial role in detecting creative practices that raise moral issues, straddling the boundary between innovation and deception (Patterson, 1987).

Circumstances and organizational problems are perceived differently, as well as decision-making processes, they are based on ethical premises, taken from the organization's hierarchy of values, creative accounting being linked not only by general ethics (Faruq, 2014), but especially by ethics norms accounting (van Helden et al., 2023). Ethics in creative accounting involves finding a balance between innovation permitted by accounting rules and regulations and adherence to fundamental ethical principles (Akenbor & Tennyson, 2014).

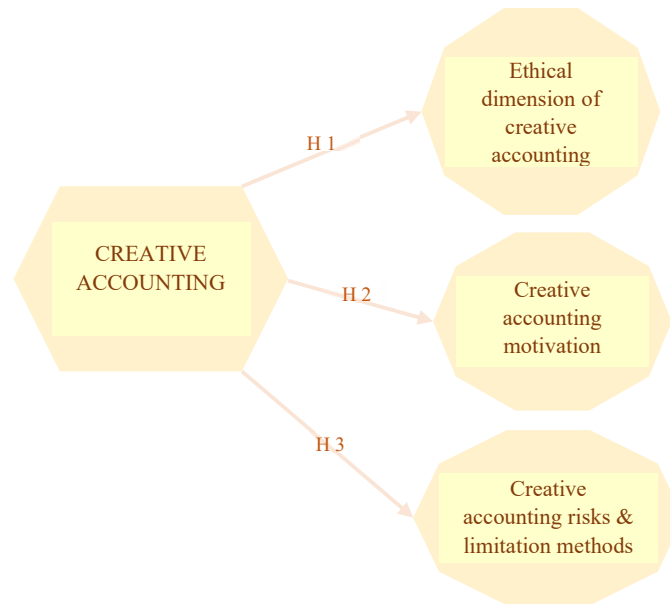
3. Research methodology

In order to fulfil the research aim objective, namely to investigate the ethical dimension of creative accounting techniques and the motivation to use such techniques, we focused our attention on obtaining empirical data, through semi-structured interviews, followed by a critical analysis.

To achieve the objectives, we formulated the following research questions:

1. What is the understanding of managers and accounting professionals on creative accounting techniques from the concept ethical perspective?
2. What are the motivations underlying the use of such techniques in financial reporting?
3. What can be the risks associated with the use of such techniques but also the methods of combating them?

Figure no. 1 Research Questions



Source: made by authors

The qualitative analysis starts from empirical data obtained from semi-structured interviews, method also used by Kokina (2019) and Cooper (2019). Invitations were sent to 32 top managers and accounting professionals and positive responses were received from 12 of them. To ensure the optimal level of data saturation, companies from various fields of activity were selected (Fugard & Potts, 2014).

The interviewees were told in the participate invitation that it is voluntary, they are not remunerated and that both their data and those of the companies are anonymous. The interviews took place in Romanian, as their mother tongue, and notes were taken during the discussions, some of the interviewees did not agree with the interviews recording, so it was desired to preserve the unitary character of the entire data collection process. The average duration of an interview was 46 minutes.

As the interviews were carried out, the answers given by the participants registered a tendency to repeat themselves, so the data saturation level was reached (Fugard & Potts, 2014). At the interviews end, the received answers were analysed, grouped according to the topic addressed and the main ideas were extracted and then the research results were determined by interpreting these data.

The main limitation of this stage is that the data comes from a limited number of professionals and managers, from a certain geographical area, the answers can be affected by the historical, cultural, economic or social factor. As a next research direction, we aim to validate the result with a widespread questionnaire of a larger scale through a quantitative analysis.

4. Findings

Creative accounting is represented by a set of tools and techniques backing the management to support an to improve the company image and to provide information in such a way that it supports its interests.

Creative accounting is based on the gaps or on the flexibility of the force accounting regulations and on the interpretation of the rules with the aim of presenting a favourable organization financial image, an aspect that is not necessarily illegal, but which can raise ethical issues: *there are provided a number of perfectly legal tools to develop creative accounting techniques: accounting options, accounting policies, accounting estimates, forecasts and involves the deliberate manipulation of financial figures to satisfy the needs of interested parties.* The line between creative accounting and tax fraud is an extremely unstable one and requires a thorough understanding of accounting standards and rules, while fraud involves the deliberate violation of existing rules and regulations, creative accounting is based on the flexible interpretation of existing rules.

In general, creative accounting is seen as a negative technique, as a method of manipulating financial statements, which can negatively influence, in particular, the decision-making process of different categories of interested parties and, in the long term, even the company itself, but which can be limited by implementing strict reporting standards, independent audits, ethical education and the use of innovative technologies. The vast majority of those interviewed believe that tax and accounting legislation are the main ones responsible in terms of the opportunities to use creative accounting techniques offered: *although the accounting rules are quite strict, we can choose certain policies, we have freedom in the game of options, in the description certain phenomena, despite the international standards adopted, there are still certain gaps in the legislation that still leave room for interpretations.*

At the basis of the motivation to use creative accounting are the reporting pressures (meeting the expectations of shareholders or creditors, avoiding the violation of financial conventions), performance-based compensation (performance-related remuneration policies can encourage the attitude towards the manipulation of situations) *(if the remuneration would does according to the achievement of the denominator performance indicators, we would most likely try to present the data in the most favourable way)*, fiscal pressure (creative accounting can be used to reduce the tax burden of companies), *(we try to optimize our tax policy, within the limits of the law)*, the need for financing (the embellishment of the financial statements can make the company attractive to creditors or investors), *(sometimes it is necessary to embellish the data in order to comply with certain loan contractual clauses or to obtain additional financing, to attract investors, the image of the company needs to be improved)*, market pressure – *(we have to be very careful about the reported figures so that the company to be attractive to potential investors)*.

Regarding the specific techniques of creative accounting, we have identified: the provisions manipulation *(depending on the company interest, certain provisions can be constituted)*, the convenient use of accounting policies *(the choice of different depreciation methods is a perfectly legal but also ethical technique and not affects the quality of reporting, quantitative or value overvaluation of inventory can be considered a creative method)* and revaluation of assets *(we revalued assets to increase the company value)*.

In general, creative accounting is seen as a negative technique, as a method of manipulating financial statements, which can negatively influence, in particular, the shareholders decision-making process *(in the past we encountered problems due to false information transmitted by to some partners, presenting a distorted financial picture could affect several partners)* and, in the long term, even the company itself *(if we reported distorted figures, we would lose our credibility among investors and among business partners as well)*, but which can be limited by a strict reporting standards discharged *(the standardization of financial reporting standards at the international level could help to reduce the existing discrepancies between different countries in the use of these practice, the standardization of reporting could reduce the flexibility interpretation, stricter guidelines on reporting rules could prevent manipulation)*, clear corporate governance policies *(the company's governance policy is clear against such practices)*, independent audits *(strict reporting and auditing standards can limit these practices, a rigorous and professional audit can help to detect and prevent abuses, the competence and integrity of the auditor can help to detect creative practices)* along with effective internal controls *(a rigorous internal control limits the risk of presenting erroneous data)*, ethical education *(professional education is essential to limit the phenomenon, it is important to ethically train accountants and managers not to use these practices, there is a very strict code of ethics at the company level that promotes transparency, an organizational culture focused on ethics and responsibility can at least discourage these practices)* and the innovative

technologies (*I believe that automation and artificial intelligence will have the ability to recognize certain methods of manipulation, automation of accounting processes reduces the flexibility of interpretations, technology will be able to detect creative techniques, artificial intelligence will have its significant role in reducing such manipulations*).

Creative accounting raises, first of all, moral issues (*It needs an ethical debate, it is on the border between innovation and fraud, it is unethical to record income before it is actually realized, regardless the certainty degree*). It uses the existing accounting rules to present the financial situation of a company in a favourable light, without the explicit violation of the regulations in force, but which can raise all ethical issues. Ethics in creative accounting involves finding the balance between innovation allowed by accounting regulations and fundamental ethical principles (*creative accounting involves changing financial information within legal limits, it is apparently legal, but I think it raises at least procedural problems, personal, I believe it is a violation of the ethical principles of the accounting profession, ethical training should be included in professional training programs, a strong ethical conscience can prevent questionable practices that compromise the integrity of reporting*).

From the discussions held, we also identified a number of relevant ethics principles in the case of creative accounting: integrity (*accountants must be honest and present information correctly and completely, respect the true representation principle*), objectivity (*reported information must be free from any type of external influence, which could lead to the reports distortion*), professionalism (*accountants and auditors must comply with the standards in force and avoid any type of behaviour that could affect their professional reputation*), transparency (*all information must be included in the reports clearly, without misleading interested parties*).

Previous studies have presented managers' interests in creative accounting for a variety of reasons. On the one hand, the potential political side of the company to use accounting mistakes but also to manipulate the transaction on the financial markets, to create an artificial image of the companies or to hide a negative impact on a community part.

The companies aim to present rather a permanent tendency to increase the results and managerial performance, so to display fluctuations in the indicators with sudden increases and decreases. Revenue growth can be a creative technique to distract from a number of unfavourable indicators, inducing the false perception of a profitable company by reducing the apparent degree of indebtedness.

A complex combination between relaxed business monitoring, the reward structure of the top management directly linked to the performance indicators, gaps in the legislation, the lack of ethical culture in business leads to a possibility of approaching an opportunistic behaviour on the part of managers that can mislead all other parts: stakeholders, regulatory authorities, shareholders and investors, creditors, employees or the general public. More empirical research has demonstrated the causal relationship between financial frauds and scandals and the lack of ethics, reporting transparency, and the professional attitude of the factors involved.

5. Conclusions

Creative accounting continues to be seen as a flexible use of financial-accounting reporting standards and norms to present a more favourable financial picture of an entity, standing on the border between legal compliance and manipulation of financial information, raising significant ethical issues.

Creative accounting is a practice that involves major risks for both companies and investors, but which can be limited by implementing strict reporting standards, independent audits, ethical education and the use of innovative technologies.

The highly complex and far-reaching phenomenon of creativity in accounting requires standardized educational and regulatory measures to ensure the integrity and transparency of financial reporting.

Creative accounting becomes an ethical issue when it is used with the specific purpose of misleading or manipulating the perception of an organization's financial results and performance. Adherence to ethical principles and the adoption of strict financial reporting standards are essential to maintaining trust in the accounting profession.

The ethics of each one of us leads us to prefer a certain side of accounting: either the technical and scientific side, based on rigor, or the creative side based on art, or the side of stake or social game, thus generating honest accounting policies or biased accounting policies. Although creative, accounting remains an exact science of numbers, and although discrete, its use is widespread.

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Sustainability Accounting Standards in Europe – A Systematic Literature Review

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Abstract

The increasing concern of the organization decision-makers towards the sustainability issue has propelled the development of sustainability accounting standards at the global level. The UN constantly carries out studies, in the framework of achieving the development goals and prevention of the climate crisis. In Europe, this change is driven by adopted regulatory frameworks, stakeholder expectations and a transition to a sustainable global economy. This article systematically reviews European sustainability reporting legislation and the academic literature, identifying frameworks, implementation challenges and also their impact on corporate performance and transparency. The research is based on works selected from the Scopus-Elsevier, ProQuest and WoS databases, the reviewed articles being published in the period 2010-2024 in the scope of sustainable accounting standards. The results show an increased interest in the digitization of corporate sustainability reporting, along with a series of organizational constraints that influence their adoption.

Key words: sustainability accounting standards, sustainability accounting framework, sustainability reporting, sustainability reporting challenges

J.E.L. classification: M480

1. Introduction

Sustainability accounting has emerged as a cornerstone for measuring and reporting environmental, social and corporate governance performance (ESG performance). In Europe, institutions such as the European Commission (EC) and the European Financial Reporting Advisory Group (EFRAG) have developed sustainability reporting frameworks, including the Corporate Sustainability Reporting Directive (CSRD). These developments in sustainable field reflect the need for harmonized standards to address sustainability challenges.

The basis of national and global economies is represented by the satisfaction of unlimited needs with the help of limited resources, and the natural disasters that we helplessly witness in this period emphasize the importance of this resource limitation. Under the umbrella of "sustainability", multiple studies and researches are conducted to counteract these effects.

The Brundtland Report (UN, 1987) elaborates the concept of sustainability as the way of using natural resources and energy in such a way as not to harm the environment (Oxford Advanced Learner's Dictionary). Goederdier (2024) provides a sustainability definition based on three dimensions for consumers: social equality, naturalness and circularity – recycling and the Office for Sustainability at the University of Mississippi attributes to it three other dimensions: economic, social and environmental. Sustainability accounting, as a branch of organizational accounting, has been asserted as a science that records, classifies, processes, summarizes, analyses, publishes and reports

data that includes social and environmental impacts, other than those in the sphere of economic events (Mansour & Spătariu, 2023).

Although the innovative information and communication technologies have managed to radically change the face of many social, economic, business or informational processes, previous studies in the accounting field focus, in particular, on the digital transformations that have taken place in the sphere of information processing and reporting financial (Mansour et al., 2022) and less on digital sustainability reporting and on their standardized format. EU Directive 2464/2022 gives increased interest to the reporting of non-financial sustainability reporting information in digitized, accessible, comparable and machine-readable formats (E.U., 2022).

The adoption and implementation of innovative technologies in sustainability reporting processes represents a challenge both for professionals in the financial field and for the corporation management, the existence of a systemic framework being necessary to ensure the support for implementation but also to monitor the collection and presentation of sustainability data (Suta & Tóth, 2023). This article is motivated by the need for regulations in the digitization of sustainability field reports that allow their free access and comparability, providing an insight into regulatory frameworks, implementation challenges and the impact on corporate performance and transparency through a systematic literature review of specialty to strengthen findings from academic research sources through the perspective of digitizing non-financial sustainability information. It aims to identify the advantages but also the challenges encountered in the implementation of non-financial reporting standards through an analysis of the existing literature.

In order to carry out a systematic analysis of the IT benefits and challenges encountered in the implementation process of sustainability reporting standards, we conduct a systematic literature review based on the Regulation-Organization-Technology theoretical framework to identify and present the trends of research on this topic. The results obtained tend to indicate a struggle regarding the adoption and implementation of information technologies in sustainability reporting between external environmental factors (pressure from interested parties to technologize the entire processing and reporting process) and internal organizational constraints (the needs of companies for high-performance technical programs and time for training and education).

To achieve the presented goal, we established the following research objectives:

1. Presentation of regulatory frameworks at European level in the field of standardized sustainability reporting;
2. Identification and structuring of organizational challenges in the implementation of these regulations through the lens of digitization;
3. The impact of these implementations on transparency and corporate performance.

The article begins with a brief introduction, presenting the research motivation, purpose and objectives. It continues with a literature review in section number two. In the third section the research methodology is detailed. Section four presents the obtained results. And the last section summarizes the conclusions and limitations of this paper.

As for the implications of the paper, it addresses both regulatory authorities and organizations, meeting their needs for digitization of creative accounting, presenting the advantages but also the challenges encountered in the application of new IT technologies for non-financial reporting purposes and disclosure of sustainability.

2. Literature review

Although the trend of increasing reporting requirements in the sustainability field is clear, the issue of non-financial information and sustainability reporting digitalization is still quite pressing. Aspects related to the content of environmental reports were analysed (Mansour & Spătariu, 2023), thus identifying the early obstacles that companies encounter in the non-financial reporting process, being addressed, especially aspects related to of the content of the reports and less those related to the increase of responsibility towards the environment, the performances improvement and their comparability. Discussions of online environmental performance reporting were addressed early on by Jones et al. (1998) whose study proposes a framework with guidelines needed to create an environmental reporting site. Lodhia et al. (2020) enhances the debate by highlighting how the communication medium has a critical role within sustainability reporting mechanisms, thus

recognizing the digital technology's ability to support those three sustainability pillars: preparation, reporting and publication (Piccarozzi et al., 2023). Flores et al. (2018) explores how XBRL reporting can support organizations' efforts to implement sustainability reporting when applying the European Environmental Management and Audit Scheme, there being concordances between ESMA reporting (EU, 2023) based on XBRL and the company's cultural environment (Mansour et al., 2023).

The first political objectives for environmental protection were outlined at the Stockholm Conference (1972), then they were reiterated and supplemented by the provisions of the Rio de Janeiro Conference (1992) and by those established at the Johannesburg Conference (2002). In 1989, the World Bank emphasized the need to develop a complex system of national accounts (System of National Accounts - SNA) that would unitarily approach the concept of sustainable development from the perspective of informational accounting systems and that would record and reflect the impact of natural and environmental resources on income companies and, implicitly, on the assets variation. This is how the environmental accounting concept appears and a conceptual framework of environmental accounts necessary for transposition within national accounting systems is developed in order to evaluate the influence of natural resources on sustainable incomes in a reliable and faithful manner (Cho et al., 2015).

The International Federation of Accounting (2005) published a report summarizing the best practices observed in the world regarding managerial accounting applied in the natural environment field. It does not meet the conditions of a rule or a regulation, but only represents an approach to analysis, a conceptual framework for definition with the aim of reducing errors in the application of environmental accounting in the natural environment field. According to him, environmental accounting must reflect reliable, real, concrete and complete data regarding the natural materials consumption, water, energy, about the waste generated as a result of the carried-out activities; monetary and financial data regarding the costs of protecting, preserving and restoring the mature environment; the gains obtained as a result of the policy aimed at environmental protection and reducing the consumption of natural resources.

EU Directive 95 (2014) is among the first non-financial reporting regulatory instruments to encourage large organizations to present ESG aspects, non-financial reporting in annual reports. Subsequently, reporting obligations were extended to more companies (EU, 2023), improving the requirements for the harmonization and standardization of ESG disclosures, with reference to transparency, coherence, comparability, timeliness and reliability. As guidelines, there are GRI standards (GSSB, 2021) intended to support the preparation of ESG reports that may be suitable for determining performance indicators in this area but also for bringing among the determinants of these indicators.

IFAC (2016) has identified the contribution of accounting information systems in achieving at least eight of the seventeen goals proposed by the UN (1987) - quality of education, gender equality, working conditions and economic growth, industry, innovation and infrastructure, consumption resource manager, etc.

At the European level, the policy of sustainable development was defined by the Single European Act adoption, which stipulates that the activities taking place in one state do not cause impairment to another state (EU, 1986). In December 2022, a series of rules were adopted that provide for the obligation of companies in member states to connect the information from the financial - accounting statements with those of sustainability (European Parliament, 2022).

If the international level is already discussing the creation of international standards for reporting environmental and governance elements (EC, 2023), Romanian environmental policies refer to aspects related to the management of waste and chemical substances and genetically modified organisms, civil protection and nuclear security, environmental protection and the provisions of EU directive 2464/2022 (European Parliament, 2022) on sustainability reporting.

3. Research methodology

The present study is based as a methodology on fundamental research aimed at identifying the essential aspects of the standardized and computerized reporting of sustainability and non-financial information.

The study begins with a bibliometric analysis of the specialized literature, for the realization of which we identified in the WoS database the articles in the accounting field, using the search keys "Sustainability reporting" and "Green Accounting". The search yielded results beginning in 1997 consisting of a final number of 1,312 articles that were analysed and mapped.

To carry out the theoretical research, we first analysed the European regulations related to non-financial sustainability reporting, starting from the year 2000, and then we selected a diverse range of national and international specialized works (articles, books, conference volumes, doctorate theses, national and international legislative sources, web sources) on the same topic that we subjected to a systematic content analysis. The systematic review process followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. Academic databases such as Scopus, Web of Science and Google Scholar were used to identify relevant publications. Keywords included "sustainability accounting", "ESG reporting", "European standards" and "sustainability frameworks". Studies published between 2020 and 2024 were considered.

4. Findings

We began the study with a bibliometric survey on the sustainability accounting inclusion in sustainability reporting research in the WoS database. Using as selection criteria of published articles "Sustainability reporting", "ESG reporting", "sustainability frameworks" "Green accounting" resulted in a number of 1,312 articles that addressed issues based on sustainability reporting during 1997 – 2024, the most numerous of these being published by the "Journal of Cleaner Production" (2.51%) and "Sustainability" (2.2%).

Figure no. 1. Publications Selected from WoS using "Sustainability reporting" theme



Source: made by authors used WoS Database

From the analysis of the generated results, it is obvious the general interest shown in connection with the topic of green accounting since 2010 - after some timid approaches to the topic in the interval 1997 - 2009 - starting from normative approaches towards empirical research, with the aim of identifying the factors determinants and green accounting impact. The researchers interest followed an upward course especially during the pandemic but also post-pandemic period (2019 – 2021), including from Romanian researchers, with studies published in the WoS database starting from 2014.

Figure no. 2. Publication Selected from WoS using AIS & Sustainability topics



Source: made by authors used WoS Database

European institutional background: towards sustainability reporting

Since the 2000th, the E.U. has started discussions to develop and implement a robust legislative framework on organizations sustainability and non-financial information reporting, with the aim of developing transparency and corporate social, environmental and governance responsibilities (E.U., 2003).

Regarding sustainability reporting, although there were provisions regarding the company's commitment that meet certain criteria of a report, there were no standard procedures for drawing up, regulation and control and no sanctions, thus resulting in differences in form and content in what the companies drawn up in their sustainability reports, but also difficulties in analysis, interpretation and comparison of the various aspects.

The Global Sustainability Standards Board (2021) has developed, following consultative discussions with parties involved in sustainability reporting processes, an international information report to enable the standardization of user reporting worldwide. So, this meets the need for standardization of sustainability reporting and proposes several provisions and a series of fundamental principles to follow for the preparation of representative sustainability reports. The GRI Report (2021) provides eight fundamental principles needed to achieve high-quality sustainable reporting, as follows in the figure no. 3.

Figure no. 3 The Fundamental Principles Necessary to Report Sustainability in Concordance with GRI Standards



Source: made by the authors based on GRI Report

At the European level, a significant first step in increasing the transparency of non-financial information was achieved in 2014 (E.U., 2014) when the adoption of E.U. Directive 95/2014 required companies with more than 500 employees to disclose information regarding policies, risks and the results of environmental, social and personnel activities, respecting human rights and fighting corruption. The regulation adopted in 2019 (European Parliament, 2019) requires financial market participants to disclose how they integrate sustainability risks in the decision-making processes regarding the investments made.

The cornerstone of European sustainability policy is represented by the Taxonomy - a company classification system that defines sustainable activities and provides the methodology needed to determine how green a company's turnover is, providing criteria for assessing contributions to mitigating change climate and other environmental objectives (European Parliament, 2020).

Table no. 1. The Classification Criteria According to the EU Taxonomy

Environmental Objectives of The EU Taxonomy	Alignment Criteria with the EU Taxonomy
Climate change mitigation	Substantial contribution to at least one of the six Environmental Objectives
Adaptation to the climate changes	
Sustainable use and protection of water and marine resources	Do not Significant Harm (DNSH) any of the Objectives
The transition to a circular economy	
Pollution prevention and control	Compliance with minimum guarantees (OECD Guidelines, UN Principles, ILO Core Conventions)
Biodiversity and ecosystem protection and restoration	

Source: made by authors

Directive 2464/2022 extends the NFRD requirements responding to the need for much more comprehensive and comparable information (E.U., 2022). It applies to a wide range of organisations, including small and medium-sized companies listed on capital markets, and introduces rigorous and detailed reporting requirements, ensuring the consistency and comparability of data reported by companies, and introduces reporting aligned with the EU Taxonomy Regulation and the Regulation on sustainable financial disclosure (SFDR), not requiring the use of sustainability reporting standards (ESRS), emphasizing the importance of external audit in the direction of sustainability.

The regulation adopted in 2024 (E.U., 2024) establishes the legislative framework for promoting investments in sustainable technologies and includes references to various European directives relevant to sustainability reporting, followed by regulation 2024/2000 (E.U., 2024) which rationalizes reporting and allows the use of reporting systems telecommunications for improving the communications infrastructure and supporting sustainability objectives. The regulations reflect the E.U.'s commitment to integrate sustainability issues in corporate reporting, respectively to promote a responsible and transparent economy.

The challenges of legislative implementation of sustainability reporting and their impact on corporate performance and transparency

The implementation at the organization levels of the legislation regarding the sustainability reporting involved on their part a series of challenges that the management but also other interested parties must address in such a way as to affect in an insignificant way the totality of the organizational processes.

Table no. 2 The challenges of legislative implementation of sustainability reporting

Implementing reporting legislation key challenges	The identified problem	The impact	References
Lack of standardization	<ul style="list-style-type: none"> - Different sustainability reporting frameworks and guidelines (GRI, SASB, TCFD) - Inconsistencies in reporting requirements 	<ul style="list-style-type: none"> - complicating the process of alignment with reporting requirements - making data comparability difficult 	Villiers & Sharma, 2020, Parvez & Satirenjit, 2021, Hummel & Szekely, 2021 Piccarozzi et al., 2023 Suta & Tóth, 2023
Complexity of data collection process	<ul style="list-style-type: none"> - additional time and resources to collect accurate and comprehensive data on ESG factors 	<ul style="list-style-type: none"> - the risk of not having the infrastructure and operational systems needed 	Mansour & Spătariu, 2023, Šimunović et al., 2024, De Silva et al., 2024
Compliance costs	<ul style="list-style-type: none"> - significant costs for the implementation of reporting systems, staff training 	<ul style="list-style-type: none"> - disproportionate effects between companies - burdens of SMEs 	Kumar et al., 2020, Pervez & Satirenjit, 2021, Mansour Et al., 2023

	-additional costs generated by hiring third-party auditors for ESG reporting		
Gaps in capacity and expertise	- the lack of experience necessary for the effective evaluation and reporting of sustainability parameters	- inappropriate, incomplete or inaccurate reporting	Hummel & Szekeley, 2021, Mansour & Spătaru, 2023, Šimunović et al., 2024
Business reluctance	- the reluctance of companies in the face of reporting requirements due to the fear of assuming reputational risks - additional costs - competitive disadvantages	- delays in adopting the regulations - low quality of reports	Hummel & Szekeley, 2021, Mansour & Spătaru, 2023, Triverdi et al., 2024
Challenges in enforcing regulations	- the lack, at the governmental level and of the regulatory bodies, of the resources necessary to monitor and enforce compliance	- undermining the effectiveness of legislation due to the lack of consistency and predictability	Abed et al., 2022, Triverdi et al., 2024
Local vs global contexts	- the lack of economic, social or environmental contextuality of some regions in relation to the legislation designed at the global level	- the difficulties of multinational companies to navigate between different requirements according to jurisdiction	Moreno, 2023
Misreporting risks	- intentional manipulation or distortion of data for a favourable image	- undermining general trust in the quality and veracity of sustainability reporting - loss of trust in ESG regulatory bodies	Metz et al., 2020, Šimunović et al., 2024
The dynamic nature of ESG issues	- the evolution over time of sustainability issues (emerging climate risks, new issues)	- the need for permanent revision of the legislation in the field	Aslaksen et al., 2021, Abed et al., 2022
Stakeholder engagement	- the challenge of aligning the interests of different stakeholders (governments, companies, investors, civil society)	- delays in implementing procedures and reporting requirements - dilution of legislation	Valentinetti & Rea, 2024, Kumar et al., 2020, Sharakhina, 2021

Source: made by authors

An effective implementation of existing sustainability reporting legislation and standards requires striking a balance between regulatory rigor and flexibility to adapt to evolving ESG priorities. In order to overcome and counteract these challenges, we also identified a series of measures that can be adopted by decision-makers and interested parties, Table no. 3.

Table no. 3 Necessary measures to improve sustainability reporting

Measures	References
Development of clear, globally standardized reporting standards	Parvez & Satirenjit, 2021, Shin et al., 2023, Šimunović et al., 2024
Providing support in order to strengthen companies' capacities to implement high-performance IT technologies	Nguyen et al., 2022, Kulkarni et al., 2023, De Silva et al., 2024, Valentinetti & Rea, 2024

Providing incentives to promote compliance	Aslaksen et al., 2021, Mousa & Ozili, 2022, Piccarozzi et al., 2023
Ensuring robust monitoring, enforcement and sanctioning mechanisms	Metz et al., 2020, Šimunović et al., 2024, Triverdi et al., 2024
Promoting transparency and collaboration between all stakeholders	Feleagă et al., 2018; Kumar et al., 2020 Sharakhina 2021, Suta et al., 2022, Harness, 2023; Moreno et al., 2023

Source: made by authors

5. Conclusions

European sustainability standards are essential in promoting transparency and accountability. Underscoring their importance, areas for improvement were identified, such as standardization and harmonization with international requirements but also support for SMEs.

The European Union plays an essential role in shaping sustainability reporting through non-financial reporting directives (NFRD, CSRD). The European sustainability accounting reporting framework is characterized by evolving regulations, constant efforts towards standardization and ongoing debates regarding the measures needed to improve efficiency and implement best reporting practices in the field. Policy development and impact studies are essential to address existing challenges but also to improve the quality and usefulness of sustainability disclosures.

The need for a unified regulatory framework for sustainable accounting both in Europe and globally is evident, with the success of existing standards in the field dependent on collaboration between decision makers, organizations and stakeholders, while education and training are crucial to build expertise in the field of sustainable accounting.

Despite progress in implementing sustainability reporting regulations, challenges in achieving consistent and comparable sustainability reporting remain: complexity and overlap, data quality and availability, resource constraints.

Future studies can focus on the long-term impact of these standards on the fulfilment of European sustainability objectives.

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The Impact of Sports Event Outcomes on Stock Market Returns: An Event Analysis

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Abstract

This paper investigates the impact of match outcomes on stock market returns, with a specific focus on two major European football clubs, Borussia Dortmund and Juventus. By applying econometric methods, the study examines the correlation between the clubs' game-day results and fluctuations in their respective stock prices. The findings reveal that Borussia Dortmund's victories result in immediate and statistically significant positive returns, extending into the following trading day. For Juventus, victories also lead to immediate positive returns, but these effects do not carry over to the subsequent day in a statistically significant way. Losses for both clubs are associated with declines in stock performance the following trading day.

This research underscores the nuanced ways sports outcomes influence investor sentiment, highlighting variability based on team performance and the timing of market reactions.

Key words: stock market returns, sports events, investor sentiment, behavioral finance

J.E.L. classification: G14, G41, L83

1. Introduction

Sports events, especially in professional leagues, hold considerable influence over fans, economies, and increasingly, financial markets. The interplay between team performance and stock market behavior is a growing field of study, reflecting the economic significance and public emotional investment in sports. When a prominent club wins or loses, fan sentiment can translate into investor behavior, affecting the stock performance of publicly traded sports organizations. Borussia Dortmund and Juventus, two football clubs listed on their respective stock exchanges, provide an ideal basis for examining these dynamics. This paper explores the influence of game-day outcomes on their stock prices, using econometric analysis to quantify the effect of wins and losses on short-term returns.

The paper contributes to the literature by assessing the differential impact of victories and defeats on stock performance for these two clubs. An econometric approach is employed to examine day-of-game and next-day stock returns, offering insight into how investor sentiment in response to sports outcomes translates into tangible financial market outcomes.

2. Theoretical background

The relationship between sports events and stock market returns is grounded in theories of behavioral finance and investor sentiment. Scholars argue that stock prices are not solely driven by financial fundamentals but are often influenced by the emotional reactions of investors to culturally or emotionally significant events, such as sports matches (Baker & Wurgler, 2007; Brown & Cliff, 2004). This phenomenon is part of a broader "mood-driven behavior" paradigm in financial markets, where emotions like euphoria or disappointment associated with game outcomes can affect investor behavior and, consequently, stock returns (Edmans et al., 2007).

Investor reactions to sports events can be linked to the concept of "sentiment contagion," where widespread emotional responses influence the buying or selling decisions of a large group of investors. Studies examining stock market reactions to international sports tournaments, such as the FIFA World Cup or the UEFA Champions League, show that a nation's stock market often benefits from the national team's success, as investor optimism translates to higher returns (Ashton et al., 2003; Kaplanski & Levy, 2010). This effect is particularly visible with clubs like Borussia Dortmund and Juventus, which have large, emotionally invested fan bases. Victories lead to widespread investor optimism, which translates into increased buying activity and, consequently, positive stock returns (Boyle & Walter, 2003; Palomino et al., 2009).

Empirical studies on mood-driven investor behavior have shown that the influence of sports outcomes is not limited to national pride. Club-level analysis reveals similar effects, with teams experiencing both positive and negative investor reactions depending on their performance. For example, studies indicate that stock prices rise on the day of a victory and often fall after a defeat, capturing the collective mood of fans-turned-investors (Berument et al., 2006).

The empirical studies also draw on evidence showing how the timing and duration of these effects can vary. For instance, Boyle and Walter (2003) note that positive returns following a victory can extend beyond the day of the event, depending on the perceived impact of the outcome. In Borussia Dortmund's case, econometric analysis reveals a 47% increase in stock returns on the day of a victory and a sustained 24% rise the following day. This aligns with other studies' findings that suggest a "momentum effect," where positive sentiment after a victory can drive further investment in the short term. On the other hand, the effects for Juventus suggest a more immediate and short-lived reaction to victories. While the current day's stock returns rise by 23% on match days, these effects do not extend into the next trading day, supporting the notion that investor enthusiasm may vary depending on broader market expectations or the club's recent performance history (Scholtens & Peenstra, 2009). This study's results add to the body of research showing that sports-related events can significantly influence stock market dynamics, albeit with varying degrees of impact across different teams and contexts (Pope & Pope, 1998).

Recent studies, such as Eissa and Al Refai (2018), suggest that major sports events like the FIFA World Cup can significantly affect stock market returns. Their research highlights how market reactions to official announcements related to such events reflect investor sentiment, which can lead to short-term fluctuations in stock prices. This aligns with previous work in behavioral finance, which links the emotional impact of sports events to broader market dynamics.

The study by Soana et al. (2021) investigates the relationship between financial markets and the UEFA Champions League (UCL), exploring whether market prices reflect the anticipation or outcomes of competition events. The authors focus on the potential informational efficiency of financial markets in response to significant UCL events, drawing on theories of market behavior and event studies. Their work extends previous literature on the interaction between sports and financial markets, analyzing the extent to which stock market movements may be influenced by factors such as team performance, match outcomes, and other events within the competition. By examining the connection between these two domains, the study contributes to the understanding of how markets respond to non-financial information, offering insights into the broader implications of sporting events on financial markets and investor behavior.

3. Research methodology

This study aims to quantify the impact of game outcomes (wins and losses) on stock returns for the football clubs Borussia Dortmund and Juventus. Juventus Football Club, based in Turin, Italy, is one of the most successful and renowned football clubs in Europe. Listed on the Borsa Italiana in December 2011 (the Italian stock exchange) under the ticker symbol JUVE.MI, Juventus offers investors an opportunity to participate in the financial performance of a top-tier football organization. It was one of the first football clubs in Italy to go public. The club's stock has garnered attention not only for its on-field success, including numerous Serie A titles, but also for the financial dynamics surrounding its brand, including sponsorship deals, media rights, and player transactions. Juventus' stock has been studied for its response to key events such as match outcomes, player signings, and managerial changes, providing a useful context for exploring the relationship between sporting

events and stock price fluctuations. Borussia Dortmund, one of Germany's most successful and popular football clubs, was publicly traded on the Frankfurt Stock Exchange in October 2000, under the ticker symbol BVB.DE. It became the first and only German football club to be publicly traded. The club's shares offer investors a stake in one of the Bundesliga's top teams, with a strong global fanbase and consistent participation in European competitions, such as the UEFA Champions League. Borussia Dortmund's stock is known to be influenced by various factors, including team performance, match results, and high-profile events like the transfer of star players. As a publicly traded entity, the stock performance of Borussia Dortmund provides valuable insights into how sporting outcomes and market sentiment intertwine, making it an ideal case study for examining how sports events impact investor behavior and stock returns.

We consider historical trading data from October 2011 to May 2023 as follows: For stock prices, we use daily trading data provided by the website investing.com. For match results, we use data from <https://www.football-data.co.uk/italym.php> (for Juventus) and <https://www.football-data.co.uk/germanym.php> (for Borussia Dortmund).

Since many matches take place on weekends, we account for the positive or negative result on the following trading day. Daily returns are calculated using the following formula:

$$Return_t = \ln \frac{P_t}{P_{t-1}} \quad (1)$$

where $Return_t$ represents the daily return, and P_t and P_{t-1} are the stock prices on day t and day $t-1$, respectively.

The econometric model used is as follows:

$$y_t = \beta_0 + \sum_{j=1}^k \beta_j \cdot \text{Explanatory variable} + \varepsilon_t \quad (2)$$

where y_t is the dependent variable, $t=1,2,\dots,T$ (time), $\sum_{j=1}^k \beta_j \cdot \text{Explanatory variable}$ is the vector of explanatory variables (regressors) multiplied with their corresponding coefficients, β_0 is the intercept, and ε_t is the random variable (error term).

This study's econometric model includes four independent variables, which are dummy variables (take the value of 1 for a win or a loss and 0 for other outcomes) and one variable representing the stock return in the previous period. The structural form of the regression is as follows:

$$Return_t = \beta_0 + \beta_1 \cdot Return_{t-1} + \beta_2 \cdot WIN_t + \beta_3 \cdot WIN_{t-1} + \beta_4 \cdot LOSS_t + \beta_5 \cdot LOSS_{t-1} + \varepsilon_{i,t} \quad (3)$$

Given the delayed response of investors in the stock market to football match outcomes, we include a one-period lag of both the explanatory variables and the dependent variable as predictors. This approach accounts for the possibility that past events may influence current returns due to reaction delays, thereby capturing any temporal dependencies in the data. We presume that the independent variables affects the dependent variable both immediately and with a delayed response (e.g., stock returns responding partially today and partially tomorrow to a football match outcome), consequently we consider including both the current and lagged versions in the same regression.

Financial returns frequently exhibit patterns of autocorrelation, especially over short horizons like daily returns. This means that today's return might be influenced by yesterday's return. For instance, in some markets, there is a tendency for returns to "mean revert" or for momentum effects to appear, where positive (or negative) returns are likely to follow previous positive (or negative) returns. By including lagged returns, we allow the model to capture these temporal dynamics, whether they are momentum effects or reversals, which are common in financial time series.

On the other hand, returns are influenced by a variety of factors, including macroeconomic indicators, investor sentiment, and recent events, many of which are not explicitly included in a daily return model due to data limitations or complexity. The lagged return incorporates some of these unobserved influences because yesterday's return is likely a result of the cumulative impact of these variables. Thus, including the lagged return can help stabilize the model, implicitly capturing the impact of these external factors.

4. Findings

Table no. 1 Econometric results for Borussia Dortmund and Juventus

Coefficients of variables	Borussia Dortmund	Juventus
Return (-1)	-0.04848*** (0.018001)	0.06585*** (0.015899)
Win	0.004766*** (0.000967)	0.002786*** (0.001057)
Lagged Win (-1)	0.002393** (0.000971)	0.001300 (0.001059)
Loss	0.001920 (0.001517)	-0.000355 (0.001628)
Lagged Loss (-1)	-0.016344*** (0.001517)	-0.008970*** (0.001628)
Number of observations (after adjustments)	2961	3913
Durbin-Watson stat	2.004	2.006

*p < 0.1; **p < 0.05; ***p < 0.01.

Source: realized by author

In the case of Borussia Dortmund, the results of the econometric study indicate a positive correlation between a win on a given day or a previous day and stock market performance from that given day. Specifically, when a victory is recorded today, stock returns increase by 0.47% on the same day and by 0.24% the next day. Conversely, a loss on the previous day leads to a decline in stock returns the following day. The coefficients are statistically significant, indicating robustness in these findings. Additionally, there is a negative correlation between the stock return on the current day and the return from the previous day. This suggests that, with other factors held constant, an increase in returns today tends to result in a decrease in returns the next day, pointing toward a market correction and stabilization effect.

The Adjusted R-squared coefficient is relatively low (5%), suggesting that the independent variables in the model account for only a small proportion of the variation in stock returns. This implies that additional control variables should be included to better capture the factors influencing market performance. Durbin-Watson value is satisfactory, indicating overall adequacy of the model.

In the case of Juventus the results of the econometric study indicate a positive correlation between a win on a given day and stock market performance from that given day. Specifically, when a victory is recorded today, stock returns increase by 0.28% on the same day. The corresponding coefficient for the impact of loss on stock returns in the same day is not statistically significant. However, there is a negative impact of loss on stock return for the following day. There is also a positive correlation between the stock return on the current day and the return of the previous day. This suggests that, with other factors held constant, an increase in returns today tends to result in an increase in returns the next day.

The Adjusted R-squared coefficient is relatively low (2%), indicating limited explanatory power and suggesting the need for additional variables. Durbin-Watson value is satisfactory, indicating overall adequacy of the model.

5. Conclusions

Based on the findings from this study, the following general conclusions can be drawn about the impact of match outcomes on stock performance. Positive match outcomes, such as wins, tend to have an immediate positive effect on stock returns for both Borussia Dortmund and Juventus. This is particularly evident in teams like Borussia Dortmund, where victories are followed by increased stock prices not only on the day of the match but also on the following day. The stock market seems to react quickly to good news, with investors possibly expecting continued positive performance. The effect of match outcomes on stock returns can extend beyond the day of the event. For example, Borussia Dortmund's stock continues to rise the day after a victory, indicating that positive sentiment from match results can influence investor behavior for multiple days. This suggests that match outcomes may affect not only short-term trading decisions but also broader investor confidence in the team's future performance.

While victories typically generate a clear positive reaction, losses on the current day result in negative stock returns on the following day for both Juventus and Borussia Dortmund. This suggests that while investors respond strongly in the same day to positive outcomes, they also tend to react to losses, albeit with a more measured adjustment in expectations. The market response to losses may be less dramatic, potentially due to other factors influencing stock performance or a more tempered investor reaction to negative events.

A correction effect of the market is also observed in the case of Borussia Dortmund, where positive returns on one day are followed by declines the next. This could indicate a short-term overreaction to match outcomes, with investors adjusting their positions after the initial market reaction. This market behavior highlights the volatility that can arise from match results, as investors reassess the true value of the stock after an initial spike. In the case of Juventus, a positive correlation between current and lagged returns is observed, suggesting that gains on one day are often followed by further positive returns the next day. This indicates a reinforcing effect, where investors' confidence in the stock continues after an initial positive reaction. Unlike a typical market correction, this pattern highlights a more sustained optimism following a win, with investors maintaining or increasing their positions based on the positive outcome, contributing to continued stock performance. There are likely some psychological and cultural differences between German and Italian investors, though it's important to recognize that individual behavior varies widely within any country.

Further studies could explore the incorporation of additional variables (e.g., global market trends, investor sentiment, team performance metrics) to more comprehensively understand how match outcomes influence stock returns. Additionally, examining a larger sample of teams or different types of sports could provide a broader perspective on how sports results impact financial markets.

6. References

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Considerations Regarding the Expansion of the Dimensions of Accounting Information Systems Recording Tools

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Abstract

The purpose of this paper is to synthesize the author's reflections on the amplification of the dimensions of the accounting information system tools. The tools used in the accounting information system are in a period of profound transformations generated by the impact of Information Technology. The hardware and software tools currently available and in the research-implementation stage allow the transition from double-entry accounting - bi-dimensional accounting to multi-dimensional accounting. New perspectives, not approached in the past, are thus opened for the processing of accounting data. Entities have ample possibilities for processing and reporting accounting information. We consider this short paper to be an introduction to research in a field that is in full expansion

Key words: system, accounting, digital

J.E.L. classification: M41, G32

1. Introduction

The instruments/procedures classically used in the accounting records of entities – the system of accounts, chronological and systematic records – are currently experiencing a process of profound amplification and modification. (www.hyperledger.org)

The widespread application of hardware and software instruments, the Internet, high-speed data networks allow a change of model, of paradigm in accounting. The necessary conditions are currently being created for the multidimensional processing of input data in the accounting computer system. (www.hyperledger.org)

Financial-accounting reporting is able to provide real-time information for decision-makers in the management of the entities' businesses. Multi-criteria accounting reporting is becoming a reality today, surpassing and amplifying the classical paradigm, the double entry in accounting.

It is currently possible to multiply the instances of accounting registers through distributed ledger computer record systems. (www.hyperledger.org)

2. Theoretical context regarding the amplification of the dimensions of the tools used in accounting information systems

In the context of the technologies available for carrying out information activities in the accounting of entities, we can note a series of changes in the accounting paradigm. Today's accountant is able to discern the trends synthesized in modern accounting systems. The use of advanced software for processing accounting input data allows for real-time financial-accounting reporting. (www.hyperledger.org)

New ways of presenting accounting information are available as a new adjunct in the decision-making process by the management of entities, at levels of hierarchical-distributed responsibility. We are in the midst of a storm of data, accounting reporting, data transmission via high-speed WiFi, 5G and 6G networks. (www.hyperledger.org)

The classic ways of accounting reporting are currently outclassed by the use of innovative tools: smartphones, tablets, laptops with unprecedented capabilities for processing accounting information. (www.hyperledger.org)

The use of distributed ledger applications - blockchain - has led to the need to rethink the accounting paradigm. We are facing challenges in terms of amplifying the legal framework for the functioning of entity accounting. The multiplication of instances of the classic accounting register requires legal justification, complementing and amplifying the patrimonial paradigm of accounting.

Research in the field of accounting is facing a series of challenges generated by the transformations in the information - computer system of entities. We are at the center of meta-theoretical changes in accounting constructs. The exponential expansion of data processing through high-speed networks connected to the Internet, correlated with software and hardware tools that have a capacity for processing big data, contributes to amplifying the central role of accountants in modern globalized business management systems. (www.hyperledger.org)

3. Research methodology - empirical aspects of the research regarding the amplification of the dimensions of the recording tools of the accounting information systems

The research methodology used in this article consists of the empirical use of data sets available on the Internet and the construction of accounting record models.

Distributed ledger technologies create new openings in the application of classical accounting concepts. The use of BigData (BD) technologies has made its presence felt in categories of accounting transactions that have a common characteristic: the analysis of large volumes of data in order to make predictions regarding the evolution of indicators in annual financial statements, the completion of predictive budgets/financial statements. Currently, the main characteristic of accounting information systems used by entities is the large volume of available data together with the use of specific methods of processing accounting data. The analysis of trends in the evolution of accounting data offers a quick way to manage information in the digital environment of accounting. There is a growing trend to integrate computer applications with artificial intelligence into accounting, based on the high processing capacities of accounting data, enabled by the use of modern systems – laptops, servers, high-speed telecommunications equipment. (www.hyperledger.org)

Without being able to generalize to all users of accounting software in Romania, from publicly available data, it emerged that both digital accounting applications purchased for a fee and solutions developed internally, at group level, are used as methods for accounting processing of data volumes. The types of data used in accounting are structured data, in monetary format, coming from sources using primary data entry devices. In terms of the types of algorithms used in accounting data processing, these are algorithms for: monitoring/history of accesses; comparing and storing data regarding input data (data history); reports/statistics for input data from primary accounting documents. (www.hyperledger.org)

4. Findings. Assessments on trends in the multidimensional use of entities' accounting tools

Users of accounting information are interested in using accounting software applications that allow data processing and reporting of financial and accounting information in real time.

The implementation of BD (BigData) solutions and data analysis through predictive models have brought competitive advantages to the accounting of the alternative passenger transport sector mediated through digital platforms over traditional forms of passenger transport accounting. The intermediation of transport services through new and innovative technological solutions contributes to increasing the degree of competition in the market and facilitates the interaction between supply and demand. The use of predictive data analysis methods reduces customer waiting time, and the use of dynamic fare setting algorithms gives them the advantage of adjusting rates, in real time, depending on various variables, such as: time, route distance, traffic and demand at the time of requesting the ride. In the market segment of digital applications, the substitutability between alternative passenger transport services and classic transport services is more intense. The competitive pressure generated by alternative transport services has determined the adaptation of

traditional transport service providers to the new digital environment in order to remain competitive. Thus, traditional passenger transport companies have developed their own digital platforms, through which customers can order a transport vehicle from the respective company, platforms similar to those that mediate alternative transport. The own digital platforms of traditional passenger transport companies operate to ensure the transmission of consumer demand to the offer represented by carriers, through transmission and reception stations. The emergence of digital applications that mediate alternative passenger transport services and those of classic companies have redefined the passenger transport services market. The entry into the Romanian market of companies that ensure the digital intermediation of alternative passenger transport services has caused dissatisfaction among traditional companies. (www.hyperledger.org)

According to open access data, Romanian companies are engaged in a broad process of digitalization of accounting reports. Computer applications are used extensively for the acquisition/entry of primary data, systematized processing with devices - laptops, tablets, smartphones, automated generation of reports and financial statements. (www.bnr.ro)

Over 95% in general and 100% in the field of banking, telecommunications, computer applications are used for the accounting of profitable entities. (www.bnr.ro)

5. A case study on aspects of implementing distributed accounting tools

Table no. 1 Table of Operations related to the enhancements of accounting tools (Nicolae, 2010).

Operations	Descriptions
01.03.2024	The entity Bixty22 sold products in installments on 01.03.2024 in the amount of 50,000,000 monetary units (mu), with recording in the distributed mirror ledger.
01.03.2024	The entries are made in the distributed mirror ledger.
01.03.2024	Installment 1 of 12,500,000 mu of the installment sale is collected
01.03.2025	Installment 2 of 12,500,000 mu of the installment sale is collected
01.03.2026	Installment 3 of 12,500,000 mu of the installment sale is collected
01.03.2027	Installment 4 of 12,500,000 mu of the installment sale is collected
31.12.2024	The interest earned in the amount of 5,000,000 mu related to the installment sale is recorded
31.12.2024	The interest recorded in the distributed mirror register in the amount of 5,000,000 mu is recorded
31.12.2025	The interest earned in the amount of 3,750,000 mu related to the installment sale is recorded
31.12.2025	The interest recorded in the distributed mirror register in the amount of 3,750,000 mu is recorded
31.12.2026	The interest earned in the amount of 2,500,000 mu related to the installment sale is recorded
31.12.2026	The interest recorded in the mirror distributed ledger in the amount of 2,500,000 mu is recorded
31.12.2027	The interest earned in the amount of 1,250,000 mu related to the installment sale is recorded
31.12.2027	The interest recorded in the mirror distributed ledger in the amount of 1,250,000 mu is recorded
01.01.2028	The overall result is recorded in the mirror distributed ledger
01.01.2028	The overall result is capitalized in the mirror distributed ledger

Source: Simulations given by the author

Accounting Information

-Accounting Proposals - Author

Table no. 2 Recording the sale of products with installment payments

Debit of Account	Credit of Account	Amount
Installment customers	Revenue from selling products in installments	50,000,000
Installment customers	Anticipated interest revenue	12,500,000

Source: Simulations given by the author

Table no. 3 Entries are made in the mirror distributed ledger

Debit of Account	Credit of Account	Amount
Distributed ledger X - Customers	Distributed ledger X - Revenue from sales of products	50,000,000
Distributed ledger X - Customers	Distributed ledger X - Customers Distributed ledger X - Deferred interest income	12,500,000

Source: Simulations given by the author

Table no. 4 The 1-st rate is collected from the sale of products

Debit of Account	Credit of Account	Amount
Available in digital currency	Installment customers	12,500,000

Source: Simulations given by the author

Table no. 5 Entries are made in the mirror distributed ledger

Debit of Account	Credit of Account	Amount
Distributed ledger X - Available in Digital Currency	Distributed ledger X - Customers	12,500,000

Source: Simulations given by the author

Table no. 6 The 2-nd rate is collected from the sale of products

Debit of Account	Credit of Account	Amount
Available in digital currency	Installment customers	12,500,000

Source: Simulations given by the author

Table no. 7 Entries are made in the mirror distributed ledger

Debit of Account	Credit of Account	Amount
Distributed ledger X - Available in Digital Currency	Distributed ledger X - Customers	12,500,000

Source: Simulations given by the author

Table no. 8 The 3-rd rate is collected from the sale of products

Debit of Account	Credit of Account	Amount
Available in digital currency	Installment customers	12,500,000

Source: Simulations given by the author

Table no. 9 Entries are made in the mirror distributed ledger

Debit of Account	Credit of Account	Amount
Distributed ledger X - Available in Digital Currency	Distributed ledger X - Customers	12,500,000

Source: Simulations given by the author

Table no. 10 The 4-th rate is collected from the sale of products

Debit of Account	Credit of Account	Amount
Available in digital currency	Installment customers	12,500,000

Source: Simulations given by the author

Table no. 11 Entries are made in the mirror distributed ledger

Debit of Account	Credit of Account	Amount
Distributed ledger X - Available in Digital Currency	Distributed ledger X - Customers	12,500,000

Source: Simulations given by the author

Table no. 12 The interest realized in the amount of 5,000,000 mu related to the installment sale is recorded

Debit of Account	Credit of Account	Amount
Anticipated interest income	Interest income	5,000,000

Source: Simulations given by the author

Table no. 12b The interest received in the amount of 5,000,000 mu related to the installment sale is recorded

Debit of Account	Credit of Account	Amount
Available in digital currency	Installment customers	5,000,000

Source: Simulations given by the author

Table no. 13 The interest recorded in the distributed mirror ledger is recorded

Debit of Account	Credit of Account	Amount
Distributed ledger X - Deferred interest income	Distributed ledger X - Interest income	5,000,000

Source: Simulations given by the author

Table no. 13b The interest collected is recorded in the distributed mirror ledger

Debit of Account	Credit of Account	Amount
Distributed ledger X - Available in Digital Currency	Distributed ledger X - Customers	5,000,000

Source: Simulations given by the author

Table no. 14 The interest realized in the amount of 3,750,000 mu related to the installment sale is recorded

Debit of Account	Credit of Account	Amount
Deferred interest income	Interest income	3,750,000

Source: Simulations given by the author

Table no. 14b The interest received in the amount of 3,750,000 mu related to the installment sale is recorded

Debit of Account	Credit of Account	Amount
Available in digital currency	Installment customers	3,750,000

Source: Simulations given by the author

Table no. 15 The interest recorded in the distributed mirror ledger is recorded

Debit of Account	Credit of Account	Amount
Distributed ledger X - Deferred interest income	Distributed ledger X - Interest income	3,750,000

Source: Simulations given by the author

Table no. 15b The interest collected is recorded in the distributed mirror ledger

Debit of Account	Credit of Account	Amount
Distributed ledger X - Available in Digital Currency	Distributed ledger X - Customers	3,750,000

Source: Simulations given by the author

Table no. 16 The interest realized in the amount of 2,500,000 mu related to the installment sale is recorded

Debit of Account	Credit of Account	Amount
Deferred interest income	Interest income	2,500,000

Source: Simulations given by the author

Table no. 16b The interest received in the amount of 2,500,000 mu related to the installment sale is recorded

Debit of Account	Credit of Account	Amount
Available in digital currency	Installment customers	2,500,000

Source: Simulations given by the author

Table no. 17 The interest recorded in the distributed mirror ledger is recorded

Debit of Account	Credit of Account	Amount
Distributed ledger X - Deferred interest income	Distributed ledger X - Interest income	2,500,000

Source: Simulations given by the author

Table no. 17b The interest collected is recorded in the distributed mirror ledger

Debit of Account	Credit of Account	Amount
Distributed ledger X - Available in Digital Currency	Distributed ledger X - Customers	2,500,000

Source: Simulations given by the author

Table no. 18 The interest realized in the amount of 1,250,000 mu related to the installment sale is recorded

Debit of Account	Credit of Account	Amount
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Source: Simulations given by the author

Table no. 18b The interest received in the amount of 1,250,000 mu related to the installment sale is recorded

Debit of Account	Credit of Account	Amount
Available in digital currency	Installment customers	1,250,000

Source: Simulations given by the author

Table no. 19 The interest recorded in the distributed mirror ledger is recorded

Debit of Account	Credit of Account	Amount
Distributed ledger X - Deferred interest income	Distributed ledger X - Interest income	1,250,000

Source: Simulations given by the author

Table no. 19b The interest collected is recorded in the distributed mirror ledger

Debit of Account	Credit of Account	Amount
Distributed ledger X - Available in Digital Currency	Distributed ledger X - Customers	1,250,000

Source: Simulations given by the author

Table no. 20 The overall result is recorded in the accounting of the reporting entity

Debit of Account	Credit of Account	Amount
Interest income	Comprehensive result	12,500,000

Source: Simulations given by the author

Table no. 21 The overall result is recorded in the mirror distributed ledger

Debit of Account	Credit of Account	Amount
Distributed ledger X - Interest income	Distributed ledger X - Comprehensive result	12,500,000

Source: Simulations given by the author

Table no. 22 The capitalization of the comprehensive result is recorded in the accounting of the reporting entity

Debit of Account	Credit of Account	Amount
Comprehensive result	Equity instruments	12,500,000

Source: Simulations given by the author

Table no. 23 The capitalization of the global result in the mirror distributed ledger is recorded

Debit of Account	Credit of Account	Amount
Distributed ledger X - Comprehensive result	Distributed ledger X - Equity instruments	12,500,000

Source: Simulations given by the author

6. Conclusions

We are currently witnessing – in my opinion – an unprecedented process of amplifying the dimensions of accounting information systems. Entities have possibilities amplified to the Nth power of processing input data into the accounting system, leading to reporting of accounting information enriched with new valences in supporting users of financial accounting statements.

Accounting – as a discipline with a thousand-year history – is in a process of decoupling from the classic system of accounting registers towards a multidimensional presentation of information. (www.hyperledger.org)

The classic paradigm of double-entry accounting is being surpassed towards integrated reporting of accounting data in a multidimensional format.

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Reflections on the Perspectives of Accounting Information Processing Paradigms in Digitalized Systems

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Abstract

The purpose of this paper is to briefly describe a series of observations by the author on the perspectives of accounting information processing paradigms in digitalized systems. Input data processing systems, primary in the accounting of entities, are in an accelerated process of transformation generated by the applicability of new digitalized technologies. The classic paradigm of double-entry accounting, based on the use of a set of accounting registers, is undergoing transformation and amplification of the possibilities of supporting the decisions of users of annual financial statements. Real-time processing of large volumes of input data in accounting allows adapting decisions made regarding business administration to new challenges and emerging trends. Integrated financial reporting of accounting information allows enriching the informational support of decisions made by users based on the information provided by the accounting of entities.

Key words: accountings paradigms, information technology

J.E.L. classification: M41, F60

1. Introduction

The widespread use of information systems – equipment and applications – in accounting constitutes a turning point in the theory and practice of accounting.

We are facing an unprecedented amplification of the capacities of processing accounting data, in online and offline systems, with the provision of output information, financial reporting to users in real time. The profound changes that have occurred in the accounting information systems of entities with varied activity profiles provide a general framework for the amplification of financial reporting. (www.hyperledger.org)

Integrated financial reporting of a collection of data describing different aspects of businesses constitutes a point of raising the informational valences of accounting in supporting users of financial statements in decision-making. (www.hyperledger.org)

2. Theoretical context regarding accounting paradigms in a digitalized system

The existence of digitalized systems for the accounting of companies represents a factor of progress in continuous expansion. (www.hyperledger.org)

We are witnessing an accelerated process of overcoming the classical accounting paradigm. (www.hyperledger.org)

Classical double-entry accounting is currently being reconstructed in a branch of conceptual developments generated by the application of new methodologies of digitalized accounting systems used by various entities in various businesses. (www.hyperledger.org)

The transition to the use of distributed ledgers, of the cloud, constitutes the moment of paradigmatic change in the conceptual approach to financial and managerial accounting.

We are witnessing a process in full expansion through which it is possible to amplify the classical processing of paper-based accounting - classical - towards a digitalized system of integrated reporting of the complex spectrum of aspects of companies' activity.

Integrated financial reporting is in a moment of expansion generated by de-localized IT applications, in particular, by the use of computers with global processing capabilities. Quantum computers are opening a new era of digitized data processing in accounting. (www.hyperledger.org)

3. Research methodology - the evolution of accounting information processing paradigm models in digitalized systems

The research methodology used in this article consists of empirical research of a set of accounting data available on the internet and building accounting models.

Accounting is faced with the challenge of adapting, in profitable conditions, to new digital technologies, such as: virtual networks, the cloud, the Internet of Things, the expansion of 5G networks, but also with the reconfiguration of business models. In addition, users of financial statements are increasingly reorienting themselves towards accounting IT applications and cloud storage spaces. According to publicly available data, investments in the digitalization of accounting infrastructure, systems and processes, through the implementation of new digital technologies, doubled by 2024. (www.ziare.ro)

Competitive pressure on the accounting services market has increased, in particular, through the emergence of new software products, which propose connectivity solutions, through networks or mobile virtual platforms. Also, accounting software applications, which use the Internet for messaging and video services, have redefined the options and attracted users of integrated accounting services. (www.hyperledger.org)

In the accounting of companies, massive amounts of data are collected, relating to the records of financial transaction details, expenses incurred, additional costs incurred, journals of added accounting data, invoicing, data that provides them with a lot of information regarding customers and suppliers. These large volumes of data of different types (structured, unstructured), generated continuously and coming from different sources, are difficult to process, in the absence of BD solutions. (www.hyperledger.org)

In the current conditions of competitive pressure on the market, generated by the challenges of new technologies and the explosion of large volumes of data, the solution foreseen by experts for the accounting of entities is represented by the automation of processes, based on artificial intelligence solutions, the realization of investments in modern networks and in BD solutions for the processing and analysis, in real time, of data sets. (www.hyperledger.org)

4. Findings. Overview of digital accounting paradigms

According to public sources, globally, in the accounting services sector, investments in artificial intelligence solutions, hardware and services will reach almost \$31.5 billion/year by 2025. BigData (BD) technologies facilitate the collection, processing and analysis of large sets of financial accounting data, in real time. (www.ziare.ro)

The results of accounting data processing are used in the decision-making process related to improving financial reporting, marketing campaigns for companies' businesses, but also for the management and optimization of the functioning of accounting data processing networks. Users of digital accounting applications can use predictive analytics to predict the evolution models of accounting indicators, for preparing reports, accounting budgets of the activity. A good forecast of the evolution of businesses allows the management of profitable entities to achieve the expected levels of profitability. (www.hyperledger.org)

The digital accounting services industry uses fraud detection systems, tools and techniques, based on data mining and machine learning algorithms, to detect anomalies in the level of expenses and to warn of their massive overrun, in real time. (www.hyperledger.org)

From the perspective of tools for processing very large sets of big data (BD), from public information, the use of modern digital tools in the accounting of entities can be observed as follows: 9% of entities exploit complete BigData (BD) instrumentation for collecting and processing large volumes of data, including BigData Analytics (BDA) processing; 11% of entities use software products applied for DataWarehouse (DW) data warehouses, using BDA software; 80% use classic financial analysis and reporting solutions. (www.ziare.ro)

BD solutions are little used for the accounting of Romanian entities, only 9% currently resorting to them. These solutions have been developed and implemented, both at the group level and at the company level. The implementation of BD solutions was a natural continuation of the development of internal IT systems, starting from DW solutions and BI business intelligence analyses, which currently coexist with the new solutions, each integrating complementary functionalities. Complex financial data analysis solutions are used in accounting by 11% of Romanian entities (according to public sources), which analyze data collected and processed through DW solutions, with complex BDA analysis techniques. (www.ziare.ro)

5. Case study of multiple entry accounting

Table no. 1 Transactions - description for amplifying accounting tools (Nicolae, 2010)

Financial operations	Brief description
01.01.2025	The entity Flex55 purchased products in installments on 01.01.2025 in the amount of 100,000,000 mu (monetary units) with payment in installments, with recording in the distributed mirror ledger.
01.01.2025	Entries are made in the distributed ledger accounting file.
01.01.2026	Installment 1 of 25,000,000 mu of the installment purchase is paid
01.01.2027	Installment 2 of 25,000,000 mu of the installment purchase is paid
01.01.2028	Installment 3 of 25,000,000 mu of the installment purchase is paid
01.01.2029	Installment 4 of 25,000,000 mu of the installment purchase is paid
31.12.2026	The interest paid in the amount of 10,000,000 mu related to the installment purchase is recorded
31.12.2026	The interest recorded in the distributed ledger accounting file in the amount of 10,000,000 mu is recorded
31.12.2027	The interest paid in the amount of 7,500,000 mu related to the installment purchase is recorded
31.12.2027	The interest recorded in the distributed ledger accounting file in the amount of 7,500,000 mu is recorded
31.12.2028	The interest paid in the amount of 5,000,000 mu related to the installment purchase
31.12.2028	The interest recorded in the distributed ledger accounting file in the amount of 5,000,000 mu is highlighted
31.12.2029	The interest paid in the amount of 2,500,000 mu related to the installment purchase is highlighted
31.12.2029	The interest recorded in the distributed ledger accounting file in the amount of 2,500,000 mu is highlighted
01.01.2030	The comprehensive result is highlighted in the distributed ledger accounting file
01.01.2030	The comprehensive result carried forward is capitalized in the distributed ledger accounting file

Source: Accounting data and accounts represent working assumptions of the author.

Accounting Information
-Accounting assumptions - Author

Table no. 2 Registration of purchase with installment payment

Debit Column	Credit Column	Amount
Technological equipment	Installment payment providers	100,000,000
Anticipated interest expenses	Installment payment providers	25,000,000

Source: Author's hypotheses

Table oo. 3 Entries are made in the distributed ledger accounting file (LeXn)

Debit Column	Credit Column	Amount
LeXn - Technological equipment	Le Xn - Installment payment providers	50,000,000
LeXn - Anticipated interest expenses	Le Xn - Installment payment providers	12,500,000

Source: Author's hypotheses

Table no. 4 Installment 1 of the installment purchase is paid

Debit Column	Credit Column	Amount
Installment payment providers	Available in digital currency	25,000,000

Source: Author's hypotheses

Table no. 5 Entries are made in the distributed ledger accounting file (LeXn)

Debit Column	Credit Column	Amount
Le Xn - Installment payment providers	LeXn - Available in digital currency	25,000,000

Source: Author's hypotheses

Table no. 6 Installment 2 of the installment purchase is paid

Debit Column	Credit Column	Amount
Installment payment providers	Available in digital currency	25,000,000

Source: Author's hypotheses

Table no. 7 Entries are made in the distributed ledger accounting file (LeXn)

Debit Column	Credit Column	Amount
Le Xn - Installment payment providers	LeXn - Available in digital currency	25,000,000

Source: Author's hypotheses

Table no. 8 Installment 3 of the installment purchase is paid

Debit Column	Credit Column	Amount
Installment payment providers	Available in digital currency	25,000,000

Source: Author's hypotheses

Table no. 9 Entries are made in the distributed ledger accounting file (LeXn)

Debit Column	Credit Column	Amount
Le Xn - Installment payment providers	LeXn - Available in digital currency	25,000,000

Source: Author's hypotheses

Table no. 10 Installment 4 of the installment purchase is paid

Debit Column	Credit Column	Amount
Installment payment providers	Available in digital currency	25,000,000

Source: Author's hypotheses

Table no. 11 Entries are made in the distributed ledger accounting file (LeXn)

Debit Column	Credit Column	Amount
Le Xn - Installment payment providers	LeXn - Available in digital currency	25,000,000

Source: Author's hypotheses

Table no. 12 The interest paid in the amount of 10,000,000 mu related to the installment purchase is highlighted

Debit Column	Credit Column	Amount
Current interest expenses	Anticipated interest expenses	10,000,000

Source: Author's hypotheses

Table no. 13 The interest on the purchase in installments is paid

Debit Column	Credit Column	Amount
Installment payment providers	Available in digital currency	10,000,000

Source: Author's hypotheses

Table no. 14 The interest recorded in the distributed ledger accounting file (LeXn) is highlighted

Debit Column	Credit Column	Amount
LeXn - Current interest expenses	LeXn - Anticipated interest expenses	10,000,000

Source: Author's hypotheses

Table no. 15 The interest paid is highlighted in the distributed ledger accounting file (LeXn)

Debit Column	Credit Column	Amount
LeXn - Installment payment providers	LeXn - Available in digital currency	10,000,000

Source: Author's hypotheses

Table no. 16 The interest paid in the amount of 7,500,000 mu related to the installment purchase is highlighted

Debit Column	Credit Column	Amount
Current interest expenses	Anticipated interest expenses	7,500,000

Source: Author's hypotheses

Table no. 17 The interest on the purchase in installments is paid

Debit Column	Credit Column	Amount
Installment payment providers	Available in digital currency	7,500,000

Source: Author's hypotheses

Table no. 18 The interest recorded in the distributed ledger accounting file (LeXn) is highlighted

Debit Column	Credit Column	Amount
LeXn - Current interest expenses	LeXn - Anticipated interest expenses	7,500,000

Source: Author's hypotheses

Table no. 19 The interest paid is highlighted in the distributed ledger accounting file (LeXn)

Debit Column	Credit Column	Amount
LeXn - Installment payment providers	LeXn - Available in digital currency	7,500,000

Source: Author's hypotheses

Table no. 20 The interest paid in the amount of 5,000,000 mu related to the installment purchase is highlighted

Debit Column	Credit Column	Amount
Current interest expenses	Anticipated interest expenses	5,000,000

Source: Author's hypotheses

Table no. 21 The interest on the purchase in installments is paid

Debit Column	Credit Column	Amount
Installment payment providers	Available in digital currency	5,000,000

Source: Author's hypotheses

Table no. 22 The interest recorded in the distributed ledger accounting file (LeXn) is highlighted

Debit Column	Credit Column	Amount
LeXn - Current interest expenses	LeXn - Anticipated interest expenses	5,000,000

Source: Author's hypotheses

Table no. 23 The interest paid is highlighted in the distributed ledger accounting file (LeXn)

Debit Column	Credit Column	Amount
LeXn - Installment payment providers	LeXn - Available in digital currency	5,000,000

Source: Author's hypotheses

Table no. 24 The interest paid in the amount of 2,500,000 mu related to the installment purchase is highlighted

Debit Column	Credit Column	Amount
Current interest expenses	Anticipated interest expenses	2,500,000

Source: Author's hypotheses

Table no. 25 The interest on the purchase in installments is paid

Debit Column	Credit Column	Amount
Installment payment providers	Available in digital currency	2,500,000

Source: Author's hypotheses

Table no. 26 The interest recorded in the distributed ledger accounting file (LeXn) is highlighted

Debit Column	Credit Column	Amount
LeXn - Current interest expenses	LeXn - Anticipated interest expenses	2,500,000

Source: Author's hypotheses

Table no. 27 The interest paid is highlighted in the distributed ledger accounting file (LeXn)

Debit Column	Credit Column	Amount
LeXn - Installment payment providers	LeXn - Available in digital currency	2,500,000

Source: Author's hypotheses

Table no. 28 The overall result is highlighted in the accounting of the reporting entity

Debit Column	Credit Column	Amount
Overall result	Current interest expenses	25,000,000

Source: Author's hypotheses

Table no. 29 The overall result is highlighted in the distributed ledger accounting file (LeXn)

Debit Column	Credit Column	Amount
LeXn - Overall result	LeXn - Current interest expenses	12,500,000

Source: Author's hypotheses

Table no. 30 The transfer of the comprehensive result to the accounting of the reporting entity is highlighted

Debit Column	Credit Column	Amount
Retained earnings – negative result	Overall result	12,500,000

Source: Author's hypotheses

Table no. 31 The transfer of the global result to the distributed ledger accounting file (LeXn) is highlighted

Debit Column	Credit Column	Amount
LeXn - Retained earnings – negative result	LeXn - Overall result	12,500,000

Source: Author's hypotheses

6. Conclusions

Our short article outlines some of the main lines of force of the changes in accounting paradigms as a result of the digital processing of input data.

The multiple effects of the extensive use of digitalized accounting tools – equipment and software applications – can be observed. The intensive use of processing large volumes of accounting data is allowed by equipment with capabilities in geometric progression in terms of data processing speeds and data storage and memorization capacities. These aspects are correlated with data networks, very high-speed internet – wifi and 5G networks.

We are witnessing a spectacular evolution of accounting paradigms in the classical system, with unprecedented ways now possible for presenting financial data, in formats enriched with useful data for decision-making by users of financial statements.

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Assessing the Impact of ESG Standards and Regulations on the Audit Process

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Abstract

The purpose of this paper is to assess the impact of ESG (Environmental, Social, and Governance) standards and regulations on the audit process. The growing significance of sustainability in business, driven by regulatory pressure, stakeholder expectations, and the demand for transparency, has transformed the audit landscape. Auditors now play a key role in verifying ESG disclosures, ensuring compliance with frameworks like the EU Taxonomy, SFDR, and TCFD recommendations, and safeguarding against risks such as greenwashing. As businesses integrate ESG criteria into their strategies, auditors must adapt methodologies to evaluate non-financial, often subjective, data. Independent assurance on ESG reporting is increasingly vital to enhance credibility, meet regulatory requirements, and build stakeholder trust. This evolution highlights the critical role of auditors in promoting transparency, accountability, and long-term business resilience in an environment where ESG factors are reshaping corporate practices globally.

Key words: ESG (Environmental, Social, Governance), Audit, Regulations, Sustainability

J.E.L. classification: M42, M49

1. Introduction

The landscape of corporate reporting is undergoing a transformation, characterized by a shift toward a more integrated approach that goes beyond the mere presentation of financial data. Companies are now expected to provide comprehensive information that encompasses Environmental, Social, and Corporate Governance (ESG) factors, as well as broader non-financial information related to sustainability. This trend is driven by the increasing demand from stakeholders for high-quality sustainability information that reflects the company's performance on these critical issues (Malchev, 2023).

In November 2022, the European Council officially approved the Corporate Sustainability Reporting Directive (CSRD), which mandates that companies disclose more comprehensive sustainability-related information. (Council of the European Union, 2022) This includes details on environmental issues, social matters, employee treatment, human rights, anti-corruption efforts, and board diversity. (European Commission 2023). The CSRD significantly expands the scope of sustainability reporting, broadens the range of entities required to report (such as listed companies, banks, and insurance firms), introduces more detailed reporting standards, and mandates assurance of the disclosed information. The directive aims to elevate sustainability reporting to the same level of importance as financial reporting, ensuring that companies provide reliable, comparable, and investor-relevant sustainability data for stakeholders (European Commission 2021).

With the growing demands for non-financial reporting and increased requirements for sustainability-related information, auditors are encountering challenges in applying the principle of materiality. This principle can be applied in ways that both enhance the reliability of the information presented and potentially undermine stakeholder interests, making it difficult to define what constitutes materiality in non-financial reporting (Baumüller & Sopp, 2021). ESG reporting, as part of non-financial disclosures, includes both qualitative disclosures on various topics and quantitative indicators to assess a company's performance in relation to ESG risks, opportunities, and strategies. The need to quantify this non-financial data often leads to confusion and uncertainty. The credibility, accuracy, and completeness of a company's environmental, social, and governance (ESG) disclosures, performance metrics, and sustainability reports are significantly strengthened through auditing (Giudice & Rigamonti, 2020). By integrating key ESG factors into the audit process, sustainability reporting can be better aligned with company objectives, while increasing transparency, accountability, and improving risk assessment (Hoang, 2018). As a result, auditors face mounting pressure to develop systematic approaches for identifying and incorporating financially material ESG factors into audit planning, execution, reporting, and assurance (Maroun, 2022). ESG auditing provides third-party verification of non-financial disclosures related to environmental stewardship, social impact, and governance standards, while also evaluating a company's data measurement, collection, and reporting practices concerning ESG performance. This ensures a more comprehensive and reliable assessment of a company's sustainability efforts (Perez, 2018).

2. Theoretical background

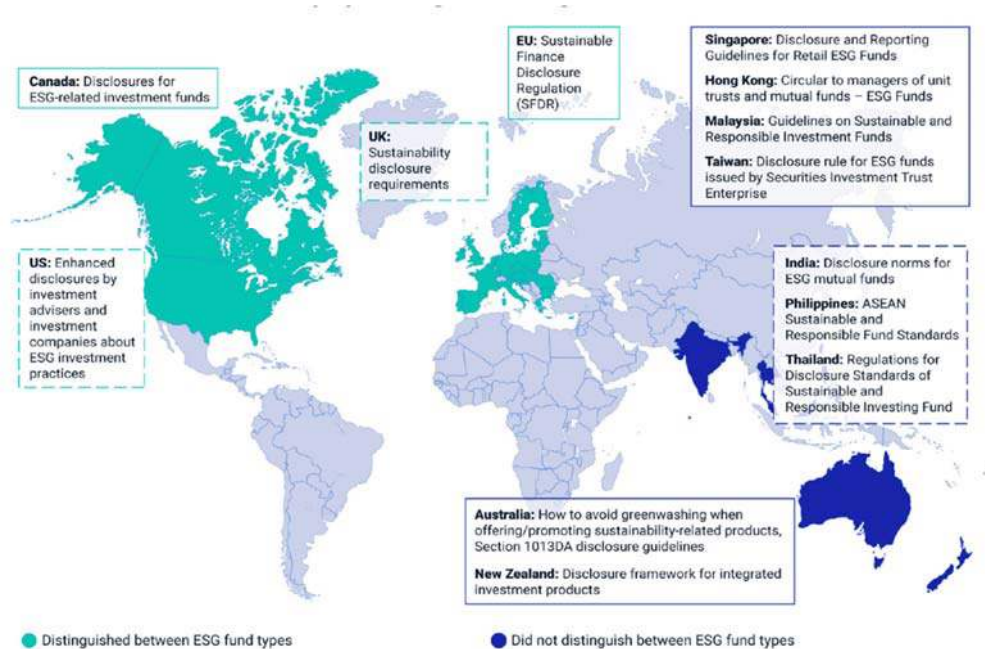
2.1 Regulatory Pressure and Growing Compliance Requirements

Corporate failures and financial crises often stem from weak corporate governance structures, which can lead to unethical practices and mismanagement. In response, many countries have developed corporate governance codes to reduce the risk of corporate collapse by combining ethics and economic rationality. However, like with IFRS adoption, distinguishing between genuine and "label" adopters remains challenging. Moreover, in emerging economies, investors still face uncertainty about the effectiveness of corporate governance mechanisms to meet rising demands for transparency and accountability, countries are adopting various corporate governance mechanisms, including external assessments, which enhance governance transparency. These assessments can boost foreign direct investment and improve market performance. However, the decision to implement corporate governance assurance often depends on whether the process is part of a publicized corporate governance rating by a credible organization, whether voluntary or mandatory (Zayyad *et al*, 2024).

The literature suggests that companies can substitute strong internal corporate governance (CG) with external CG mechanisms, such as high-quality audits. When a high-quality audit is in place, companies may be less inclined to pursue Corporate Governance Assurance (CGA), as both are external mechanisms aimed at addressing the same issue—information asymmetry. In environments with weak enforcement, where CGA results are not part of a widely recognized rating system, companies with strong audit practices may see little incentive to invest in CGA, viewing it as an unnecessary expense. High-quality audits are typically associated with the reputation of the audit firm, and the "Big 4" multinational audit firms—Ernst & Young (EY), Deloitte, PricewaterhouseCoopers (PwC), and KPMG—are considered the standard for top-tier audit quality (Alon and Dwyer, 2012; Jiang *et al*, 2019; Zayyad *et al*, 2024).

A key point of debate concerns the implementation of CSR and ESG practices, and the potential negative financial impact of sustainable investing. Companies are likely to adopt ESG practices when they expect the benefits to outweigh the costs. Managerial decisions to voluntarily disclose ESG or CSR information arise from the trade-off between anticipated costs and benefits. As a result, corporate ESG or CSR initiatives can have significant implications for financial performance (CFP), as companies actively promote their positive actions by sharing ESG or CSR information that meets or exceeds stakeholder expectations (Tsatsaronis, 2023).

Figure no. 1. Jurisdictions with active and proposed regulations of guidelines for ESG funds



Source: MSCI Report 2023 – ESG and Climate Trends to watch for 2023 - <https://www.msci.com/documents/1296102/35124068/ESG+and+Climate+Trends+to+Watch+for+2023.pdf>

2.2 Mitigation of Greenwashing risks

As ESG reporting becomes a competitive tool for companies, there is a growing risk of "greenwashing," where firms exaggerate or mislead the public about their ESG performance. Audit processes are essential in identifying and preventing greenwashing, ensuring that companies do not make misleading claims about their environmental or social impacts. This is particularly important as investors and consumers demand more accountability and transparency in ESG reporting (Clinton, 2024).

Since the early 2000s, the market for ESG information, analytics, and ratings has expanded, focusing on assessing how companies manage material ESG risks (the "outside-in" approach) and the broader impact of corporate activities on ESG (the "inside-out" approach). Many of these products now also evaluate ESG-labeled collective investment funds, with varying interpretations of how ESG risks are integrated into investment strategies. This growth aligns with the rise of ESG-related investing, which has moved from a niche to mainstream strategy, with terms like "ESG," "green," "climate," and "sustainable" becoming common labels. Policy initiatives in the EU and other regions are driving the mobilization of finance for sustainable goals, while financial product providers have responded by offering more hybrid financial and sustainable products to retail investors. However, the expansion of ESG investing has increased the risk of "greenwashing," as investors struggle to understand the true meaning of ESG labels and whether funds align with their preferences. This uncertainty has prompted regulators to oversee the design and marketing of ESG products. While many ESG information providers do not intentionally mislead, their credibility impacts the design and distribution of investment products. To address these issues, the EU is introducing regulations for ESG information providers, or "ESG infomediaries" (Chiu, 2024).

Greenwashing refers to the deceptive practice where companies exaggerate or mislead the public about their environmental efforts to distract from their actual environmental problems. This disconnect between ESG disclosures and real performance is often used to gain consumer trust, enhance reputation, secure government support, or attract investors. Such practices undermine the

effectiveness of ESG investments and reflect corporate irresponsibility. Companies often engage in selective disclosure, emphasizing positive ESG aspects while concealing negative information.

They may report achievements in environmental protection while intentionally avoiding disclosures of environmental accidents or pollution records. Another form of greenwashing involves making unrealistic or empty promises, such as committing to net-zero emissions without a clear roadmap or actions. Additionally, some firms fabricate or exaggerate their ESG data, making it difficult for third parties to verify their claims. The halo effect occurs when companies with significant environmental issues highlight a few green products or initiatives to overshadow their broader impact. Non-disclosure of negative information is another tactic, where firms purposely omit details of ESG failures or environmental harm. Lastly, green packaging is used to create an environmentally friendly image, even when the product or business itself is not sustainable. These practices not only mislead stakeholders but also erode corporate credibility and undermine the integrity of ESG efforts (Tian & Niu, 2024).

2.3 Evolution of audit methodologies

The understanding that audit risk is directly impacted by business risk has propelled the development of audit methodologies. This concept first surfaced in the mid-1990s and paved the way for the creation of business process-oriented methodologies like Strategic Systems Auditing (SSA) and Business Risk Auditing (BRA). To assess audit risks more successfully, these approaches placed a strong emphasis on comprehending a client's business strategies, procedures, and hazards. This change was influenced by several factors, including the growth of consulting services, technological breakthroughs, and rising assurance requirements. While technological advancements increased the necessity of integrating business risks into risk assessment, big audit firms encouraged BRA to expand their service offerings. Critics contend that BRA failed to stop significant financial disasters (like Enron) and raised questions over auditor independence and audit quality, despite the positives, which include enhanced risk evaluation and increased client value. To address its limitations, post-Enron regulatory reforms attempted to integrate aspects of business risk auditing with conventional transaction-focused methodologies (Vilsanoiu & Serban, 2010).

The idea of audit was incorporated into Romanian regulations in the late 1990s in response to the need to increase the reliability of accounting data reported in financial statements and by using worldwide best practices. It is important to note that, in Romania up until 1999, the chartered accountant was in charge of providing independent opinions regarding whether the financial accounts provide a fair, transparent, and complete picture of the assets and results of the economic unit through the censors' institution. The Romanian government applied for a structural adjustment loan from the World Bank in 1999, with the understanding that our nation would quickly adopt globally accepted accounting and auditing standards. According to GEO no. 75/1999 on financial audit, which was created in Romania in 1999 as a direct result of this interaction with the World Bank, a financial audit is the process of examining financial statements in order for auditors to provide an opinion that is in line with audit standards, harmonized with international audit standards, and approved by the Chamber of Financial Auditors (Laptes *et al*, 2014).

In a 2018 study on the evolution of audit fees, Dey Mith. R. and Lucy Lim found a strong link between rising rates and more audit hours required to meet new rules and less competition in the auditing sector. Additionally, they discovered that the majority of the greater increase in unexpected audit fees happened during the earlier period in their sample, from 2000 to 2004, when the audit industry underwent significant regulatory changes that led to an increase in audit hours and a rapid increase in wages due to labor supply constraints. The adoption of Auditing Standard No. 5 in 2007 increased the efficiency of auditing internal control, which in turn reduced audit hours and audit fees. In the latter part of their sample, they discovered that the smaller increase in unexpected audit fees may be due to several factors, including the auditor's progression along the learning curve of SOX Section 404, which required fewer audit hours (Dey & Lim, 2018).

In recent years, technology integration has drastically changed audit procedures, improving the process' efficacy, accuracy, and efficiency. It was previously difficult for auditors to obtain and evaluate large amounts of data from a variety of sources, including financial systems, consumer transactions, and operational records, but this is no longer the case in the digital age. A more

thorough comprehension of the audited company is made possible by this enhanced data access. Deeper insights and quicker identification of possible problems are made possible by advanced analytical techniques, like as artificial intelligence, which allow auditors to identify trends, abnormalities, and dangers that could otherwise go overlooked. By managing time-consuming duties like data collecting, conformity verification, and report production, automation further expedites the process, reducing human error and freeing up auditors to concentrate on intricate decision-making. Technology also makes it easier to monitor in real time, which helps auditors react fast to shifts in the corporate environment. However, despite the power of these technological tools, human expertise remains essential for interpreting data, understanding the business context, and offering valuable recommendations. To improve audit procedures and provide clients with more value, the change requires striking a balance between sophisticated technology and expert human judgment (Gemylang et al., 2024).

2.4 Global trend toward sustainability

Although it is difficult given the interdependencies or connections between individual goals and the fact that each goal has multiple indicators, assessing progress toward the Sustainable Development Goals is essential for assessing a nation's sustainability.

Sustainable development has grown over the years into a global strategic goal that has culminated in the 2030 Agenda and its 17 Sustainable Development Goals (SDGs), which bring together individuals, governments, and businesses to address interrelated social, economic, and environmental issues. Building on the achievements of the Millennium Development Goals (MDGs), the 2030 Agenda for Sustainable Development shifts global efforts toward an integrated sustainability viewpoint that integrates economic, social, and environmental goals. As the world works to achieve the 17 SDGs by 2030, it highlights how interconnected these dimensions are and acknowledges that tackling poverty, environmental conservation, and shared prosperity calls for teamwork, creative solutions, and meticulous progress tracking using all-encompassing indicators (Petrosillo *et al*, 2024).

Building on the Millennium Development Goals (MDGs), the 2030 Agenda emphasizes a comprehensive approach to sustainable development, stressing the interdependence of social, ecological, and economic elements. A more comprehensive framework is provided by the Sustainable Development Goals (SDGs), which emphasize the relationship between peace, partnership, prosperity, and the environment. Achieving lasting results requires examining synergies and resolving trade-offs between objectives because interactions can either facilitate or impede progress. Long-term global sustainability is promoted by balanced development, when improvements in one field do not come at the expense of another (Kuc-Czarnecka *et al*, 2023).

Aspects of social well-being like income distribution, access to necessities, health, education, and environmental sustainability are frequently neglected in favor of economic progress. GDP growth by itself doesn't tell us whether rising output and consumption actually make people's lives better or solve urgent global issues. Meeting human needs within the limits of the planet should be the top priority of any endeavor to improve wellbeing, with an emphasis on stable environments and fair access to resources. In order to provide a more equitable and sustainable framework for development, this strategy calls for new metrics that assess environmental health, societal well-being, and long-term generational prospects in addition to traditional economic indicators (Kreinin & Aigner, 2021).

The absence of all-encompassing criteria to accurately assess environmental sustainability is still a major problem, especially when it comes to the various environmental problems impeding social and economic advancement. Although indices like the Ecological Footprint, Happy Planet Index, Environmental Performance Index, and Environmental Vulnerability Index offer insightful information, they frequently fall short of completely incorporating the environmental aspects of sustainable development into larger frameworks like the SDGs. Since both economic productivity and human survival depend on healthy ecosystems, environmental sustainability is fundamental. Achieving true sustainability requires addressing the depletion of natural resources, which highlights the necessity of reliable indicators and coordinated approaches (Tothova & Heglasova, 2022).

3. Research methodology

This research technique focuses on future developments and their effects on the worldwide market by thoroughly analyzing and contrasting numerous studies on audit and ESG (Environmental, Social, and Governance) standards and regulations from reputable databases such as Web of Science and Scopus. To fully examine the development of both ESG standards and audit procedures, the technique comprises a methodical analysis of the body of literature from its conception to the present. The research is carried out from two angles: first, it looks at how standards and legislation have evolved, and second, it does a macro analysis of how audit procedures and ESG trends have changed over time.

Studies were chosen based on their thoroughness, reliability, and applicability. The analysis encompassed over 20 research papers from across the globe, meticulously selected from reputable databases. This selection included both seminal works from earlier decades and more recent studies. The deliberate inclusion of articles dating back to the 1990s was aimed at providing a comprehensive perspective on the evolution of ESG standards and regulations and their impact on the audit process over time, enabling a nuanced understanding of its development and progress. The integration of diverse temporal viewpoints ensures a robust and well-rounded foundation for the analysis, reflecting both historical context and contemporary advancements in the field. The impact of ESG norms and regulations on the audit process throughout time was evaluated using a chronological methodology. To ensure a thorough grasp of how ESG standards and laws have impacted the audit process and how audit processes have changed in response, comparative analysis approaches were used to find trends, patterns, and noteworthy changes. This method offers insightful information about the dynamic interplay between audit procedures and ESG advancements.

4. Findings

The most efficient way to include important sustainability considerations into assurance procedures is thought to be risk based ESG audits. In contrast to alternatives like continuous monitoring systems and stakeholder engagement audits, which mostly depend on the opinions of decision-makers, risk-based auditing emphasizes the precision, openness, and responsive governance required to reduce hazards like greenwashing. This method provides more relevant assurance by integrating particular ESG criteria linked to higher corporate risk profiles and financial relevance, particularly in uncertain markets where business model sustainability is becoming a significant concern. In audit innovation, striking a balance between standardization and customization necessitates carefully incorporating the viewpoints of various stakeholders. Modernizing ESG audits using technology and evidence-based practices must be a top priority for organizations, investors, assurance providers, and global standard-setters. By improving information reliability, artificial intelligence, sophisticated analytics, and simulation can satisfy stakeholders' growing needs for a comprehensive evaluation of morally and conducted company operations. Businesses may successfully show their dedication to responsible governance by proactively controlling the scope, frequency, and transparency of ESG audits. In the end, being able to match sustainable objectives with ethical behavior will foster enduring trust in communities (Ojetunde, et. al 2024).

Assessing how ESG standards and regulations affect the auditing process emphasises how crucial accurate sustainability reporting is becoming. Even though financial reporting is now standardised worldwide, non-financial reporting—including ESG data—is still in its infancy, which could result in errors that compromise the validity of ESG rankings. A crucial instrument for resolving this problem and boosting the legitimacy of voluntary disclosures is third-party assurance. ESG assurance's voluntary nature and related expenses, however, make broad adoption difficult. Since corporate scandals can harm a company's brand and investor faith, audits are crucial in identifying misrepresentation and stopping greenwashing. As ESG regulations continue to evolve, the audit process must adapt to ensure accurate, transparent, and credible sustainability assessments (Del Giudice & Rigamonti, 2020).

5. Conclusions

The results of a comprehensive examination of the most pertinent elements pertaining to how ESG regulations and standards affect the auditing process are presented in this research study. From the perspective of regulatory pressure and expanding compliance regulations, the regulatory environment and the reliability of external assessments determine how successful corporate governance instruments like Corporate Governance Assurance (CGA) and high-quality audits are. Businesses with robust auditing procedures, particularly those from "Big 4" organizations, might not feel the need for more CGA in areas with little regulation. To guarantee that these methods actually improve openness, accountability, and market performance, emerging economies must fortify legislation and raise the legitimacy of governance ratings. Although auditing techniques improved to better evaluate corporate risks, others contend they were unable to stop significant scandals. Adopting international standards in the late 1990s brought Romania's processes into line with those of other countries. Although audit fees increased at first because of more stringent requirements, efficiency improvements eventually decreased expenses. The interdependence between the Sustainable Development Goals (SDGs) and their indicators makes it difficult to evaluate progress toward them. In order to achieve balanced development and manage trade-offs, the 2030 Agenda places a strong emphasis on integrating social, economic, and environmental aspects. There is a need for new, comprehensive indicators because traditional metrics like GDP frequently overlook important factors like well-being and environmental sustainability. The shortcomings of the current environmental indices highlight the need for more trustworthy frameworks in order to attain true sustainability.

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A Multi-agent System Based On LLM For Trading Financial Assets

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Abstract

In this paper, we propose an agent-based system including Large Language Models (LLM). It depicts a multi-agent system architecture for cryptocurrency trading, consisting of five distinct agents: an Analyst, a Data Scientist, a Strategy Developer, a Trading Advisor, and a Risk Manager. Each agent performs a specific task using search and scraping tools to gather necessary information. These agents then collaborate to manage all aspects of the trading process. The OpenAI API is utilized to generate outputs from the agents. Three trading scenarios are proposed: moderate risk tolerance with position trading, high risk tolerance with scalping, and low risk tolerance with swing trading. Experimental results show that each agent effectively contributes to the trading strategy. For instance, position trading benefits from comprehensive risk analysis and mitigation strategies, scalping relies on detailed execution plans and risk management protocols, and swing trading focuses on market trends and regulatory impacts.

Key words: AI, multi-agent system, cryptocurrency, trading strategies, risk management

J.E.L. classification: G12, D81, G32

1. Introduction

Trading Bitcoin and other cryptocurrencies involves buying and selling digital assets to profit from price fluctuations (Aalborg, Molnár and de Vries, 2019). Cryptocurrency markets are decentralized and operate 24/7, allowing traders to buy and sell at any time. Popular cryptocurrencies include Bitcoin, Ethereum, Ripple and Litecoin. There are various trading strategies to consider. Day trading involves buying and selling within a single day to capitalize on short-term price movements. Swing trading holds cryptocurrencies for several days or weeks to benefit from medium-term trends. Scalping makes multiple trades within a day to profit from small price changes, while position trading holds cryptocurrencies for extended periods, often months or years, based on long-term market trends. Selecting a reliable cryptocurrency exchange is essential. Binance is known for its extensive range of cryptocurrencies and low trading fees. Coinbase offers a user-friendly interface and high security, making it suitable for beginners. Kraken provides various trading pairs and advanced features, while Bitfinex is known for high liquidity and margin trading options. When it comes to wallets and security, hot wallets are online wallets convenient for frequent trading but more vulnerable to hacks. Cold wallets, such as hardware wallets like Ledger and Trezor, offer enhanced security by storing assets offline. Security practices such as enabling two-factor authentication (2FA), using strong passwords and being cautious of phishing attempts are essential.

Technical analysis for trading involves studying historical price charts and trading volumes to predict future price movements (Hong and Zhang, 2023), (Bâra, Oprea and Panait, 2024). Key tools and indicators include candlestick charts, which visually represent price movements within a specific time frame, moving averages that smooth out price data to identify trends, the Relative Strength Index (RSI) that measures the magnitude of recent price changes to evaluate overbought or oversold conditions and the MACD, which combines moving averages to show potential buy and sell signals (Day et al., 2023), (Bâra and Oprea, 2024). Short-, medium- and long-term predictions are also

important. It is recommended to assess the models during a period of market turmoil and test during bear market conditions to determine their robustness even when market trends change between validation and test phases (Sebastião and Godinho, 2021). Fundamental analysis evaluates the intrinsic value of a cryptocurrency based on project fundamentals, market news and adoption rates. This involves analyzing the technology, team and roadmap of the cryptocurrency, studying regulatory developments, partnerships and market sentiment (Wei, Sermpinis and Stasinakis, 2023), (Feng, Wang and Zhang, 2018), and tracking the usage and acceptance of the cryptocurrency in real-world applications. Effective risk management as in any market is important to avoid significant losses. Setting stop-loss orders automatically sells a cryptocurrency when it reaches a certain price to limit losses. Diversifying investments across different cryptocurrencies helps mitigate risk. Position sizing determines the appropriate amount to invest in each trade based on risk tolerance. Cryptocurrency trading regulations vary by country, and it is important to know local regulations. Utilizing various resources and tools can enhance trading strategies (Fakharchian, 2023). News websites like CoinDesk, CoinTelegraph and CryptoSlate provide the latest market news. Data platforms like CoinMarketCap and CoinGecko offer market data and analysis. Trading bots such as 3Commas and Cryptohopper execute trades based on predefined strategies. Trading Bitcoin and other cryptocurrencies bring financial benefits, but it also require thorough knowledge and planning. Understanding the market, utilizing technical and fundamental analysis, managing risks effectively and studying regulatory and psychological factors can improve chances of success in the volatile world of cryptocurrency trading (Oprea, Georgescu and Băra, 2024), (Băra et al., 2024).

For the multi-agent system architecture, we propose five distinct agents (workers) initiated by (Moura, 2024): an Analyst, a Data Scientist, a Strategy Developer, a Trading Advisor and a Risk Manager. Each agent is responsible for a specific task, utilizing searching and scraping tools to gather the necessary information. These agents then collaborate, with each focusing on their respective roles, to form a cohesive team that effectively handles all aspects of the trading process. Three trading scenarios are proposed and interpreted. The OpenAI API key is used to generate the output of the entire crew.

2. Literature review

Several research papers aimed to evaluate the effectiveness of three widely-used algorithmic trading strategies: RSI, Moving Average Convergence Divergence (MACD) and Pivot Reversal (PR) in the context of Bitcoin trading. Using daily Bitcoin price data spanning from 2013 to 2018, the study employed particle swarm optimization to fine-tune these strategies. The findings reveal that the RSI strategy underperformed compared to the traditional buy-and-hold approach. Conversely, the MACD and PR strategies outperformed the buy-and-hold strategy. Furthermore, the optimization process enhanced the performance of these strategies even further, yielding superior results. This study presents a hybrid trading strategy that combines machine learning techniques with traditional trading strategies. The authors argue that their approach generates significantly higher returns than conventional methods. They also emphasize the importance of sentiment analysis, extracting reliable information from narratives to inform their trading models (Cohen, 2021).

Despite advancements in technical analysis and machine learning, developing effective Bitcoin trading strategies remains challenging. Deep reinforcement learning algorithms have recently shown promise, yet current studies fall short in simultaneously maximizing profits, minimizing risk, and maintaining high trade activity (Otabek and Choi, 2024). This study introduced a multi-level deep Q-network (M-DQN) that used historical Bitcoin price data and Twitter sentiment analysis. The authors proposed a novel preprocessing pipeline and reward function designed to meet the three critical objectives. Their experimental results showed a 29.93% increase in investment value and a Sharpe Ratio above 2.7.

Another paper detailed the NLP-CIMAT team's system for the PAN 2023 shared task (Villa-Cueva et al., 2023). The task involves three classification subtasks with limited data: predicting influencer magnitude, classifying interests, and predicting tweet intent. The authors' approach used pre-trained language models with two training frameworks: traditional fine-tuning and entailment-based fine-tuning. Traditional fine-tuning trains a transformer encoder to directly predict tweet classes, while entailment-based fine-tuning reframes the classification as an entailment problem,

benefiting low-resource scenarios. Both methods performed well, so the authors combined their strengths using a soft-voting ensemble. They also used data augmentation by generating synthetic tweets with ChatGPT. Their system ranked first in the second subtask and performed competitively in the other two, securing first place overall.

Cryptocurrencies, often poorly regulated and anonymous, have seen a rise in fraudulent tokens that exploit hype to raise funds and then vanish, harming investors and legitimate projects (Ueno et al., 2023). This study aimed to detect fraudulent cryptocurrencies using natural language processing (NLP) and machine learning techniques on whitepapers. The authors analyzed 250 whitepapers (150 fraudulent, 100 legitimate), extracting features and applying various machine learning methods for classification. Their best model achieved an F1 score of 0.841. K-Means clustering also showed potential in detecting fraud where criteria are undefined. Findings indicated that fraudulent whitepapers use more business and finance terms, while legitimate ones focus on technical blockchain terms. This demonstrated that NLP and machine learning can effectively identify fraudulent cryptocurrencies, aiding investors and regulators.

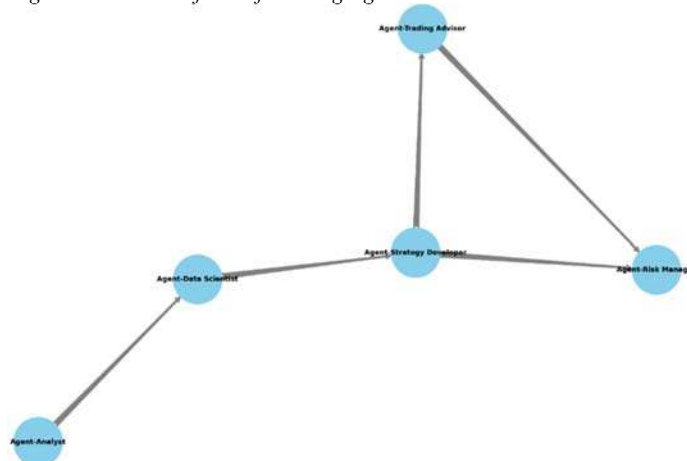
Blockchain has revolutionized finance, boosting cryptocurrency adoption. Social media sentiment greatly influences cryptocurrency markets, making sentiment analysis crucial for predicting trends (Wahidur et al., 2024). Another paper examined fine-tuning large language models to enhance sentiment analysis. Experiments showed a 40% performance gain in zero-shot tasks post fine-tuning. Larger models, with instruction-based tuning, achieved 75.16% accuracy, while smaller models might struggle with generalization. Short, simple instructions improve accuracy by 12% over complex ones, with optimal performance at a corpus size of 6,000 data points. Microsoft's MiniLM excelled in data efficiency, and Google's FLAN-T5 performed consistently well. This study emphasized model scale, instruction complexity, and corpus size in improving sentiment analysis for cryptocurrency market predictions.

An analysis of AI-themed crypto assets revealed notable abnormal returns, peaking at 41% over the two weeks following ChatGPT's debut (Ante and Demir, 2024). Additionally, 90% of these tokens showed positive abnormal returns. This indicated that the increased focus on ChatGPT and AI positively influenced cryptocurrency markets, boosting prices for AI-related cryptocurrencies. These findings highlighted a significant spillover effect, where the popularity and media coverage of ChatGPT enhanced investor sentiment and interest in AI-themed crypto assets, leading to substantial price impacts.

3. Research methodology

For the multi-agent system architecture, we propose 5 agents: Analyst, Data scientist, Strategy developer, Trading advisor and Risk manager. These agents perform 5 tasks (one task for each agent) using searching and scraping tools to search and extract the required information. Then, they form a crew of 5 agents with 5 tasks as in Figure 1.

Figure no. 1. Workflow of trading agents



Source: the authors

The agent-analysist monitors, analyzes and displays market data in real-time to identify trends and predict market movements. The agent-data scientist predicts market movements and displays prediction results. This agent employs statistical modeling, machine learning and deep learning to deliver medium- and short-term predictions. The agent-strategy developer tests various trading strategies based on insights from the agent-analyst, exemplifying diverse trading approaches. This agent evaluates the performance of different approaches to determine the most profitable and risk-averse options. The agent-trading advisor suggests optimal trade execution strategies based on approved trading strategies, demonstrating how the optimal strategy is chosen. This agent specializes in analyzing the timing, price and logistical details of potential trades. By evaluating these factors, it provides well-founded suggestions for when and how trades should be executed to maximize efficiency and adherence to strategy. The fifth agent - agent-risk manager evaluates and provides insights on the risks associated with potential trading activities, displaying the risks.

OpenAI (model="gpt-3.5-turbo") is used to generate the suggestions provided by the 5 agents. To exemplify how these agents work together, three scenarios are proposed: Scenario 1 - moderate risk tolerance with position trading; Scenario 2 - high risk tolerance with scalping; Scenario 3 - low risk tolerance with swing trading.

In Scenario 1, the trader selects Bitcoin with an initial capital of 3 BTC. They have a *moderate risk* tolerance and prefer the *position trading strategy*, which involves holding positions for several months to years to capitalize on major price movements. This strategy requires extensive research and analysis, combining technical and fundamental analysis. The trader is also highly attentive to news impacts, adjusting their positions based on significant news events affecting the cryptocurrency market. The expected approach involves long-term holding periods, low trade frequency and balanced risk management using stop-loss orders and diversification.

In Scenario 2, the trader again selects Bitcoin with an initial capital of 3 BTC but has a *high risk* tolerance and prefers the *scalping strategy*. Scalping involves making numerous trades to profit from small price changes within minutes or hours. This strategy demands continuous market monitoring and quick reactions to news events, relying primarily on technical analysis with real-time data. The trader's news sensitivity is extremely high, as news can cause rapid price movements, necessitating quick trade adjustments. The expected approach involves very short-term holding periods, very high trade frequency and tight stop-loss orders for risk management.

In Scenario 3, the trader selects Bitcoin with an initial capital of 3 BTC, exhibiting a *low risk* tolerance and preferring the *swing trading strategy*. Swing trading involves holding positions for several days to weeks to capitalize on expected market swings, balancing between short-term and medium-term gains. This approach combines technical analysis for short-term trends and fundamental analysis, with a cautious stance towards news impacts. The trader adjusts their positions based on impactful news and employs conservative risk management strategies, such as stop-loss orders and careful position sizing. The expected approach involves short to medium-term holding periods, moderate trade frequency, and a cautious, balanced approach to risk.

The settings of the trading are provided in Table 1.

Table no. 1. Trading scenarios

Scenario 1	Scenario 2	Scenario 3
trading_inputs = {'selection':'Bitcoin', 'initial_capital':'3', 'risk_tolerance': 'Moderate', 'trading_strategy_preference':'Position Trading', 'news_impact_consideration': True}	trading_inputs = { 'selection':'Bitcoin', 'initial_capital':'3', 'risk_tolerance':'High', 'trading_strategy_preference':'Scalping', 'news_impact_consideration': True}	trading_inputs = { 'selection':'Bitcoin', 'initial_capital':'3', 'risk_tolerance':'Low', 'trading_strategy_preference':'Swing Trading', 'news_impact_consideration': True}

Source: the authors

In Scenario 1, the trader selects Bitcoin with an initial capital of 3 BTC. They have a moderate risk tolerance and prefer the position trading strategy, which involves holding positions for several months to years to capitalize on major price movements. This strategy requires extensive research and analysis, combining technical and fundamental analysis. The trader is also highly attentive to

news impacts, adjusting their positions based on significant news events affecting the cryptocurrency market. The expected approach involves long-term holding periods, low trade frequency and balanced risk management using stop-loss orders and diversification. An example trade sequence might look like this: In January, the trader buys 1 BTC at \$30,000. In March, after market analysis, the trader buys another 1 BTC at \$28,000. He holds both BTCs as the market trends upwards, ignoring minor fluctuations. In July, major regulatory news causes a temporary dip to \$26,000, but the trader holds through the dip. Finally, in December, after a significant upward trend, he sells the 2 BTC at \$50,000.

In Scenario 2, the trader again selects Bitcoin with an initial capital of 3 BTC, but has a high risk tolerance and prefers the scalping strategy. Scalping involves making numerous trades to profit from small price changes within minutes or hours. This strategy demands continuous market monitoring and quick reactions to news events, relying primarily on technical analysis with real-time data. The trader's news sensitivity is extremely high, as news can cause rapid price movements, necessitating quick trade adjustments. The expected approach involves very short-term holding periods, very high trade frequency, and tight stop-loss orders for risk management. An example trade sequence might include buying 0.1 BTC at \$30,000 and selling it at \$30,100 within an hour. Next, traders might buy 0.1 BTC at \$30,050 and sell it at \$30,120 after 30 minutes. They could then buy 0.1 BTC at \$30,110 and sell it at \$30,150 within 15 minutes. A quick reaction to positive news might lead to buying 0.1 BTC at \$30,200 and selling it at \$30,350 within minutes. This pattern of small, rapid trades would continue throughout the day.

In Scenario 3, the trader selects Bitcoin with an initial capital of 3 BTC, exhibiting a low risk tolerance and preferring the swing trading strategy. Swing trading involves holding positions for several days to weeks to capitalize on expected market swings, balancing between short-term and medium-term gains. This approach combines technical analysis for short-term trends and fundamental analysis, with a cautious stance towards news impacts. The trader adjusts their positions based on impactful news and employs conservative risk management strategies, such as stop-loss orders and careful position sizing. The expected approach involves short to medium-term holding periods, moderate trade frequency, and a cautious, balanced approach to risk. An example trade sequence might begin with buying 0.5 BTC at \$30,000 in January. In February, after a short-term upward trend, they sell 0.5 BTC at \$35,000. In March, after a dip, they buy another 0.5 BTC at \$32,000. Following positive market news in April, they hold through the upward trend. Finally, in June, after market analysis indicates a peak, they sell 0.5 BTC at \$40,000.

These example trades illustrate how each trading strategy operates in different market scenarios. Position trading involves fewer trades with longer holding periods, focusing on significant price movements and major trends, with trades based on thorough market analysis and news impacts. Scalping involves numerous quick trades to capitalize on small price changes, requiring constant market monitoring and quick reactions to news events. Swing trading balances short to medium-term holding periods with fewer trades than scalping but more than position trading, capitalizing on market swings and adjusting based on news and technical analysis. When it comes to trading strategies in stock markets, investors often exhibit diverse preferences based on their risk tolerance, investment goals and market outlook. Several commonly preferred trading strategies are displayed in Table 2.

Table no. 2. Trading strategies description

Trading strategies	Definition	Preference	Risk
Day Trading	Day traders buy and sell stocks within the same trading day to capitalize on short-term price movements	This strategy is preferred by traders looking for quick profits and willing to monitor the markets continuously	High, due to rapid market changes
Swing Trading	Swing traders hold stocks for several days to weeks, aiming to profit from expected market swings	Favored by those who want to capitalize on market volatility without the need for constant monitoring	Moderate, influenced by broader market trends
Value Investing	Value investors seek undervalued stocks that are trading below their intrinsic value, aiming for long-term appreciation	Suitable for investors with a long-term horizon who believe in fundamental analysis	Lower, though depends on the accuracy of the intrinsic value assessment
Growth Investing	Growth investors focus on companies expected to grow at an above-average rate compared to others	Ideal for those looking to invest in innovative companies with high growth potential	High, due to the speculative nature of growth projections

Momentum Trading	Momentum traders buy stocks showing an upward price trend and sell them when the momentum starts to decline	Chosen by investors looking to exploit market psychology and trends	High, as it relies on continuous market movement
Dividend Investing	Dividend investors focus on stocks that pay regular dividends, providing a steady income stream	Preferred by income-focused investors and those seeking lower-risk investments	Lower, given the stability of dividend-paying stocks
Index Investing	Index investors buy index funds or ETFs that track a market index like the S&P 500	Suitable for passive investors looking for broad market exposure with lower management fees	Moderate, as it mirrors the overall market performance
Algorithmic Trading	Uses algorithms and automated systems to execute trades based on predefined criteria	Embraced by those with access to technology and data analytics, seeking to leverage speed and precision	Varies, depending on the algorithm's robustness and market conditions
Contrarian Investing	Contrarian investors go against prevailing market trends by buying stocks that are out of favor and selling those that are popular	Chosen by investors who believe markets overreact and misprice assets	High, as it involves betting against market sentiment

Source: the authors

Other trading preferences can be followed, such as position trading consisting in holding positions for several months to years to profit from major price movements. Its key features refer to long-term, trend following, lower frequency of trades, moderate risk. Position trading is a long-term trading strategy where investors hold positions in securities for an extended period, typically ranging from several months to years. The primary goal of position trading is to profit from major price movements or trends in the market. Position traders maintain their investments for longer periods, unlike day traders or swing traders who operate on shorter time frames. They aim to capitalize on significant price trends rather than short-term fluctuations. This strategy relies heavily on identifying and following long-term trends. Traders use technical analysis, fundamental analysis or a combination of both to identify potential entry and exit points based on trend patterns. Position traders execute fewer trades compared to day traders or swing traders. The focus is on making substantial gains from a few well-researched positions. Extensive research and analysis are essential for position traders to identify promising opportunities. They often look at economic indicators, company financials, industry trends and other macroeconomic factors. Position trading involves holding positions for long periods, which can expose traders to various risks, including market volatility and economic changes. Effective risk management strategies, such as stop-loss orders and diversification, are essential to protect against significant losses. Position traders need to stick to their strategy, even during market corrections or short-term volatility. They must be able to withstand market fluctuations without reacting impulsively. They often focus on assets with strong fundamental value and potential for long-term growth.

On the other hand, scalping consists in making numerous trades to profit from small price changes and is related to very short-term, high frequency, high risk. Penny stock trading consists in trading low-priced, small-cap stocks, characterized by high risk, potential for significant gains, requires thorough research. Pairs trading means simultaneously buying and selling two correlated stocks to profit from the relative price movement. It is market neutral and relies on statistical analysis, moderate risk. Sector rotation consists of moving investments between sectors based on economic cycles on medium to long-term and it requires understanding of economic indicators, having moderate risk. Technical trading consists of using technical analysis tools and charts to make trading decisions on short-term or long-term; it relies on patterns and indicators, variable risk. Fundamental trading consists of making trading decisions based on fundamental analysis of a company's financial health and performance in the long term. It focuses on intrinsic value with lower risk. Arbitrage consists of exploiting price differences of the same asset in different markets in short-term. It relies on price inefficiencies with low risk (if executed correctly). News trading consists of making trades based on market-moving news and events in the short term. It requires quick reaction to news and has a high risk. Options trading consists of using options contracts to speculate or hedge in the short-term or long-term using various strategies (e.g., calls, puts, spreads). It is characterized by high risk. Quantitative trading consists of using quantitative analysis and mathematical models to make trading decisions. It relies on data and algorithms, can be short-term or long-term, variable risk.

Each of these strategies caters to different investor preferences, risk tolerances and market. Choosing the strategy depends on individual goals, investment horizon and the amount of time one can dedicate to managing their investments (Ferko et al., 2023). Many of these trading strategies are valid and can be applied to Bitcoin trading and other cryptocurrencies. Table 3 shows how they translate to the context of Bitcoin trading.

Table no. 3. Trading strategies applied to cryptocurrencies

	Description	Key Features
Day Trading	Buying and selling Bitcoin within the same trading day	Quick profits, high frequency of trades, requires constant monitoring
Swing Trading	Holding Bitcoin for several days to weeks to capitalize on expected market swings	Medium-term, exploits market volatility, moderate risk
Value Investing	Investing in Bitcoin when it is perceived to be undervalued	Long-term, based on perceived intrinsic value, lower risk
Growth Investing	Investing in Bitcoin based on its potential for future growth and adoption	Long-term, focus on growth potential, higher risk
Momentum Trading	Buying Bitcoin when its price is trending upwards and selling when momentum declines	Short to medium-term, trend following, high risk
Dividend Investing	Not applicable to Bitcoin as it does not pay dividends	-
Index Investing	Investing in cryptocurrency indices or ETFs that include Bitcoin	Long-term, passive investment, moderate risk
Algorithmic Trading	Using algorithms and automated systems to trade Bitcoin based on predefined criteria	Can be short-term or long-term, relies on technology, variable risk
Contrarian Investing	Investing in Bitcoin against prevailing market trends	Long-term, requires strong conviction, high risk
Position Trading	Holding Bitcoin for several months to years to profit from major price movements	Long-term, trend following, lower frequency of trades, moderate risk
Scalping	Making numerous trades to profit from small price changes in Bitcoin.	Very short-term, high frequency, high risk.
Penny Stock Trading	Not directly applicable to Bitcoin, but similar strategies can be applied to low-cap cryptocurrencies	-
Pairs Trading	Simultaneously buying and selling two correlated cryptocurrencies, such as Bitcoin and Ethereum	Market neutral, relies on statistical analysis, moderate risk
Sector Rotation	Rotating investments between different types of cryptocurrencies based on market conditions	Medium to long-term, requires understanding of market trends, moderate risk
Technical Trading	Using technical analysis tools and charts to trade Bitcoin	Can be short-term or long-term, relies on patterns and indicators, variable risk
Fundamental Trading	Making trading decisions based on the fundamental analysis of Bitcoin's market conditions, adoption rate, and technological developments	Long-term, focuses on intrinsic value, lower risk
Arbitrage	Exploiting price differences of Bitcoin on different exchanges	Short-term, relies on price inefficiencies, low risk (if executed correctly)
News Trading	Making trades based on market-moving news and events related to Bitcoin	Short-term, requires quick reaction to news, high risk
Options Trading	Using Bitcoin options to speculate or hedge	Can be short-term or long-term, various strategies (e.g., calls, puts, spreads), high risk
Quantitative Trading	Using quantitative analysis and mathematical models to trade Bitcoin	Relies on data and algorithms, can be short-term or long-term, variable risk

Source: the authors

These strategies can be adapted to Bitcoin and other cryptocurrencies, though it is important to consider the unique characteristics and higher volatility of the crypto market. More specific trading preference strategies for Bitcoin are: (a) ICO investing that consists in investing in Initial Coin Offerings (ICOs) of new cryptocurrencies. It is suitable for investors looking to get in early on potentially high-growth projects. The risk is very high, due to the speculative nature and potential for scams; (b) Staking means holding and "staking" cryptocurrencies to earn rewards or interest. It is preferred by those seeking passive income from their crypto holdings. The risk is moderate, as it depends on the stability and security of the staking platform; (c) Yield farming consisting of providing liquidity to DeFi protocols in exchange for interest or token rewards. It is ideal for investors looking to maximize returns from their crypto assets. The risk is high, due to smart contract vulnerabilities and market fluctuations; (d) Margin trading consists of using borrowed funds to trade larger positions in cryptocurrencies. It is suitable for experienced traders looking to amplify their gains. The risk is very high, as it involves the risk of liquidation and significant losses.

4. Findings

The following output is produced by the proposed crew of agents (as in Table 4).

Table no. 4. Results with the proposed crew of agents

<p>Crew output for Scenario 1</p> <p>The following output is produced by the crew: After conducting a comprehensive risk analysis of the proposed trading strategies for Bitcoin, here are the detailed insights on potential risks and effective mitigation strategies:</p> <ol style="list-style-type: none"> 1. Regulatory Risk: Uncertainty around cryptocurrency regulations can impact trading strategies. Mitigation: Stay informed about regulatory developments and adjust strategies accordingly. 2. Security Risk: Potential hacking, malware, and operational glitches can threaten the security of Bitcoin transactions. Mitigation: Use secure wallets and exchanges, implement strong security measures, and stay vigilant against cyber threats. 3. Insurance Risk: Cryptocurrencies like Bitcoin are not insured by traditional entities like SIPC or FDIC, leaving investments vulnerable. Mitigation: Opt for exchanges with insurance coverage to protect investments. 4. Fraud Risk: Despite blockchain security measures, fraudulent activities can still occur in the cryptocurrency market. Mitigation: Exercise caution, verify sources, and be wary of potential scams to minimize the risk of fraud. 5. Market Risk: The volatile nature of Bitcoin prices poses a significant market risk for traders and investors. Mitigation: Diversify investments, stay updated on market trends and news events, and be prepared for price fluctuations by implementing risk management techniques like stop-loss orders. <p>By considering these risks and implementing the suggested mitigation strategies, traders and investors can navigate the dynamic Bitcoin market effectively, maximize profits, and manage risks efficiently.</p>
<p>Crew output for Scenario 2</p> <p>After conducting thorough research and analysis, I have compiled detailed execution plans for trading Bitcoin during an uptrend. Utilizing Moving Averages, Buying the Dips, HODLing, Dollar-Cost Averaging, Trend Following, Oversold in Uptrend Approach, and Exploring Various Trading Strategies. It is crucial to closely monitor market movements, adapt strategies accordingly, and prioritize risk management to optimize trading outcomes for Bitcoin. In evaluating the risks associated with these strategies, some potential risks include market volatility leading to unexpected price movements, regulatory changes impacting the cryptocurrency market, security breaches and hacking incidents, liquidity issues affecting trade execution, and the potential for market manipulation. To mitigate these risks, it is recommended to implement strict risk management protocols, including setting stop-loss orders, diversifying the portfolio, staying informed on market news and developments, utilizing secure trading platforms, and continuously reassessing and adjusting strategies based on market conditions. By following these recommendations and prioritizing risk management, the team can navigate the Bitcoin market with confidence and efficiency, maximizing trading outcomes during the uptrend period.</p>
<p>Crew output for Scenario 3</p> <p>After evaluating the risks associated with the proposed trading strategies and execution plans for Bitcoin, it is evident that the imminent launch of spot ether ETFs in the U.S. and the SEC suing Consensus over MetaMask staking and broker allegations pose significant challenges and opportunities for the cryptocurrency market, including Bitcoin.</p> <ol style="list-style-type: none"> 1. Impact of Spot Ether ETFs Launch: The approval of spot ether ETFs by the U.S. Securities and Exchange Commission (SEC) could lead to substantial net inflows into the cryptocurrency market, potentially affecting the price dynamics of Ethereum and other cryptocurrencies. This influx of capital may create increased volatility in the market, impacting trading strategies for Bitcoin. It is crucial to monitor the developments closely and adjust trading plans accordingly to capitalize on potential opportunities while managing market risks. 2. SEC Lawsuit Against Consensus: The SEC's lawsuit against Consensus over MetaMask staking and broker allegations highlights the regulatory scrutiny faced by cryptocurrency platforms and services. The allegations of violating federal securities laws and collecting fees through crypto asset transactions and staking services underscore the legal risks associated with operating in the cryptocurrency space. This legal action could have broader implications for the regulatory environment and market sentiment, influencing trading strategies and risk exposure for Bitcoin. It is essential to assess the potential implications of the lawsuit on the cryptocurrency market and adjust risk management strategies accordingly. <p>Mitigation Strategies: To mitigate the risks associated with the proposed trading strategies and execution plans for Bitcoin, the following strategies are recommended:</p> <ol style="list-style-type: none"> 1. Diversification: Consider diversifying the trading portfolio to reduce concentration risk and exposure to specific market events, such as the launch of spot ether ETFs and regulatory actions against cryptocurrency platforms. 2. Risk Hedging: Implement risk hedging strategies, such as options contracts or futures, to protect against adverse price movements and market uncertainties resulting from external events like regulatory actions and market inflows. 3. Regulatory Compliance: Stay informed about regulatory developments and ensure compliance with relevant laws and guidelines to mitigate legal risks and maintain the integrity of trading activities. 4. Continuous Monitoring: Monitor market trends, news updates, and regulatory announcements to adjust trading strategies promptly in response to changing market conditions and risk factors. <p>By incorporating these mitigation strategies into the trading plans and execution strategies for Bitcoin, it is possible to navigate the risks effectively and capitalize on market opportunities while safeguarding the investment portfolio against potential challenges.</p>

Source: the authors

The interpretation of Scenario 1: moderate risk tolerance with position trading is given in this paragraph. The crew's output for Scenario 1 fits well with the chosen strategy. Position trading, which involves holding positions for several months to years, requires a comprehensive understanding of potential risks and mitigation strategies. The crew's insights into regulatory risk, security risk, insurance risk, fraud risk and market risk align perfectly with the needs of a position trader. By staying informed about regulatory developments, using secure wallets and exchanges, opting for insured exchanges, exercising caution against fraud and diversifying investments, the trader can effectively manage risks. These strategies ensure that the trader can navigate the dynamic Bitcoin market, maximize profits and manage risks efficiently over the long term.

The interpretation of Scenario 2: high risk tolerance with scalping is the following: in Scenario 2, the crew's output emphasizes detailed execution plans for trading Bitcoin during an uptrend, which is crucial for a scalper. The use of techniques such as Moving Averages, Buying the Dips, HODLing, Dollar-Cost Averaging, Trend Following and the Oversold in Uptrend Approach, along with exploring various trading strategies, provides a solid foundation for a high-frequency trading strategy. The crew also identifies potential risks such as market volatility, regulatory changes, security breaches, liquidity issues and market manipulation. To mitigate these risks, they recommend implementing strict risk management protocols, setting stop-loss orders, diversifying the portfolio, staying informed on market news and using secure trading platforms. These recommendations ensure that the scalper can optimize trading outcomes while effectively managing risks in a highly volatile environment.

The interpretation of Scenario 3: low risk tolerance with swing trading is given in this paragraph. For Scenario 3, the crew's output addresses the imminent launch of spot ether ETFs and the SEC lawsuit against Consensusys, highlighting their potential impact on the cryptocurrency market, including Bitcoin. The crew's focus on diversification, risk hedging, regulatory compliance and continuous monitoring aligns with the swing trading strategy, which involves holding positions for several days to weeks to capitalize on market swings. By considering the impact of major events and adjusting trading plans accordingly, the swing trader can navigate increased market volatility and regulatory scrutiny. The crew's recommendations to diversify the portfolio, implement risk hedging strategies, stay informed about regulatory developments and continuously monitor market trends ensure that the trader can capitalize on opportunities while managing risks effectively.

5. Conclusions

This study introduces a multi-agent system architecture for cryptocurrency trading, composed of five specialized agents: Analyst, Data Scientist, Strategy Developer, Trading Advisor, and Risk Manager. Each agent focuses on a distinct task, employing advanced tools to gather and analyze data, thereby forming a cohesive team that addresses all aspects of the trading process. The use of the OpenAI API to generate outputs from these agents further enhances the system's capabilities. Key findings from our experiments highlight the effectiveness of this multi-agent approach across various trading scenarios: (1) Position Trading (Moderate Risk Tolerance): The comprehensive risk analysis and mitigation strategies provided by the agents align well with the needs of position traders. By addressing regulatory, security, insurance, fraud and market risks, the agents help position traders navigate the dynamic Bitcoin market, ensuring long-term profitability and effective risk management; (2) Scalping (High Risk Tolerance): The detailed execution plans and risk management protocols tailored for high-frequency trading prove crucial for scalpers. Techniques such as Moving Averages, Buying the Dips, HODLing, and Dollar-Cost Averaging, combined with real-time market monitoring, enable scalpers to optimize trading outcomes while managing the high volatility and risks associated with this strategy; (3) Swing Trading (Low Risk Tolerance): The focus on major market events, like the launch of spot ether ETFs and regulatory actions, underscores the importance of diversification, risk hedging, regulatory compliance, and continuous market monitoring.

By distributing specialized tasks among dedicated agents, traders can achieve better decision-making, improved risk management, and optimized trading performance. This approach not only caters to different trading preferences and risk tolerances but also provides a robust framework for adapting to the evolving landscape of cryptocurrency markets. Therefore, the crew's outputs for each scenario fit well with the respective trading strategies. For the moderate-risk position trader in

Scenario 1, the focus on long-term risk management and mitigation strategies is crucial. The high-risk scalper in Scenario 2 benefits from detailed execution plans and risk management protocols to handle market volatility. The low-risk swing trader in Scenario 3 is supported by insights into regulatory impacts and strategies to manage market risks. Each output provides customized insights and recommendations that align with the trader's risk tolerance, strategy preference and the dynamic nature of the Bitcoin market.

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ESG Disclosure: Evidence from Romanian Banking Sector

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Abstract

Starting from the three factors represented by the acronym ESG: environmental, social, governance, the central objective of this research is to identify the main ESG actions of the Romanian banking system.

The research hypothesis is that most banking institutions show interest in ESG reporting. The research methodology was based on a qualitative analysis of non-financial reports published by banks in Romania, for the year 2023; the research conducted trying to demonstrate the orientation of banks towards the adoption of ESG strategies. Given the crucial role that banks have in the national economy, this paper wants to highlight the current level of ESG reporting of banks, in order to support the improvement of sustainability practices.

Key words: ESG, banking, sustainability report, annual report, nonfinancial reporting

J.E.L. classification: Q56, M41, G21

1. Introduction

In a world where awareness of global issues is essential, the ESG concept has become one of the most discussed topics in business discussions and decisions. It causes companies to look beyond financial indicators and focus on the impact that businesses have on the community.

Thus, environmental, social and governance (ESG) considerations have become increasingly important in the process of communicating with stakeholders.

ESG refers to a wide range of environmental, social and governance factors that can be used to assess how companies manage their performance and impact in terms of sustainability. These factors can be assessed either from the inside out (how the company's operations affect certain ESG aspects) or from the outside in (how certain ESG aspects affect society). (BVB, 2022)

The banking system contributes to economic growth both locally and globally. Through their internal programs, banks are often the pioneers in implementing sustainable indicators, such as ESG. This change, observed since the early 1990s, caused by the awareness of climate and social challenges, responds to the needs of society and constantly changing regulations. (Purcarea, 2024)

2. Literature review

In 2014, the European Directive on the reporting of non-financial information (Directive 2014/95/EU) was adopted, the most important legislative act that introduced reporting obligations regarding sustainability for companies with over 500 employees in the European Union.

In Romanian legislation, the provisions of the European directive were transposed through Orders of the Minister of Public Finance (OMFP 1802/2014, OMFP 2844/2016, OMFP 1938/2016, OMFP 3456/2018).

The purpose of this type of reporting is to assess the consequences of economic activity on environmental, social and governance aspects, and the presentation of information should be done in the form of a non-financial statement.

Recently, the integration of environmental, social and governance (ESG) factors into business practices has gained significant attention for its potential to stimulate sustainable development. (Leoveanu, 2024)

The main advantages of integrating sustainable development objectives in the banking sector, especially through ESG principles, are: a better reputation of a bank, risk optimization, strict compliance with constantly changing regulations. (Purcarea, 2024)

In addition to reputation, the ESG Reporting Guide, developed by the BVB, also highlights the following benefits of a high level of ESG performance and transparency: risk management, operational performance, new business opportunities, access to capital and financing, communication with stakeholders.

The concept of ESG is a framework for companies that want to become more sustainable and responsible. ESG is a complex concept that involves a lot of elements and requirements, but to better understand this concept, we can divide these requirements into three main categories: environmental, social and governance.

The figure below gives examples of different aspects related to ESG.

Figure no. 1 ESG factors



Source:

<https://www.checkatrade.com/blog/trade/business-management/what-is-esg-and-why-is-it-important>

3. Research methodology

This paper aims to analyze the level of ESG reporting by banks in Romania, in the current legislative, economic and social context.

In this regard, we will analyze the environmental, social and governance information reported by banks for the year 2023.

We consider it appropriate to analyze the 2023 reports for several reasons:

- after almost ten years since the adoption of the European Directive, it is important to analyze the quality of the non-financial reporting process,
- the year 2023 is in the post-pandemic period of COVID 19, a possible year of economic recovery,
- at the same time, the year 2023 represents the moment of transition from the provisions of the Non-Financial Reporting Directive (NFRD) to those of the Corporate Sustainability Reporting Directive (CSRD).

Although there are 32 banks operating in Romania (according to the National Bank of Romania), for this paper, the sample consists of the top 10 banks, classified by the value of assets in 2023 (Medrega, 2024).

In order to synthesize the main actions in the ESG sphere, we will conduct research on the banks in the sample, through a qualitative analysis of the non-financial reports published by them.

We consider it important to understand the ESG approach at the level of the Romanian banking industry, and to achieve this objective, this paper will answer the following research questions:

Q.1: What are the main ESG strategies adopted by banks in Romania?
Q.2: What are the means of communicating ESG information and how accessible are they to users?

Table no.1 ESG Actions – Romanian banking sector

Bank	ESG Actions
Banca Transilvania	<ul style="list-style-type: none"> ➤ Financing energy efficiency projects, smart agriculture, efficient transport and water efficiency; ➤ 75% of the electricity purchased came from renewable sources; ➤ Recycling plastic from cards; ➤ Developing digital payment solutions, namely the establishment of the first digital bank in Romania – Salt Bank; ➤ Launching financial education programs for clients; ➤ Financing actions for NGOs and supporting local communities; ➤ Staff training activities; ➤ Financing small companies.
BCR	<ul style="list-style-type: none"> ➤ Financing small and medium-sized enterprises; ➤ Launching the first 100% online mortgage loan, called "CASA MEA"; ➤ BCR recorded an increase in green financing, and through the George application, it facilitated access for individuals and micro-enterprises to offers for financing electric vehicles; ➤ Digitalization of the application process for the III Pillar of pensions administered by BCR Pensii; ➤ Issued green Eurobonds worth 700 million euros, and the funds raised were used for renewable energy projects, green mortgages and green buildings; ➤ Use of ecological materials for issuing cards; ➤ All electricity purchased in 2023 came from renewable sources; ➤ Initiation of financial education programs for customers and non-customers; ➤ BCR launched a corporate venture capital company (BCR Seed Starter), through which it aims to provide capital for startups that have the potential to optimize internal banking processes, improve the portfolio of services offered to BCR customers or to support the integration of ESG standards.
CEC Bank	<ul style="list-style-type: none"> ➤ CEC Bank uses eco-friendly cards, made of recycled plastic and with biodegradable elements; ➤ Within the bank, waste is collected selectively, LEDs are used and electronic systems are used for various activities, in order to reduce paper consumption; ➤ It is involved in CSR activities, which support education and health projects; ➤ CEC Bank has developed a virtual store, called "CEC_IN", where the most important banking products can be accessed 100% online; ➤ In 2023, the bank granted loans to individuals under the First Home Program, respectively granted green loans mainly for the implementation of projects with a non-refundable European component; ➤ CEC Bank charges advantageous interest rates on the "Casa Mea Verde" mortgage loan, to encourage the purchase of energy-efficient homes; ➤ To support local authorities in rural areas, CEC Bank grants them loans for projects in the fields of health, education and social assistance; ➤ CEC Bank launched a new type of loan for farmers who grow cereals, to support Romanian agriculture.

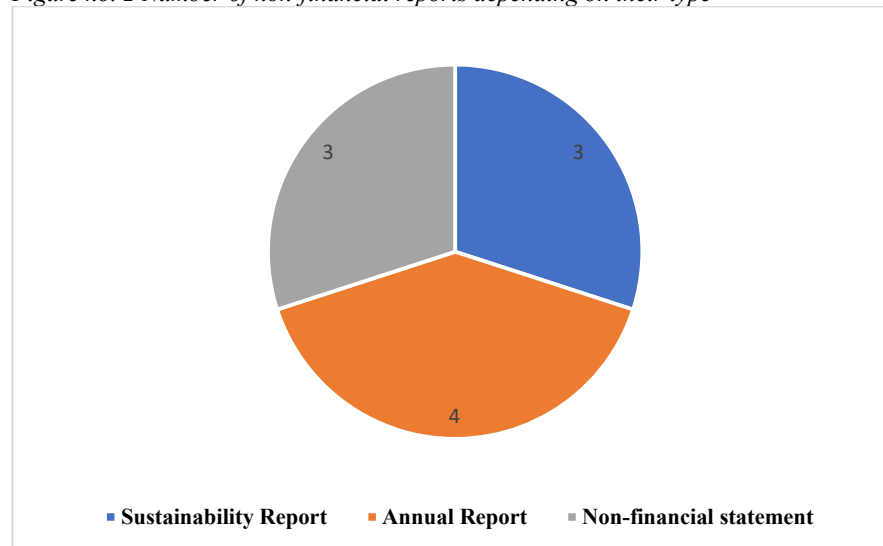
BRD	<ul style="list-style-type: none"> ➤ It has implemented several energy efficiency projects, such as the installation of photovoltaic panels on 20 BRD buildings, and the purchase of 100% green energy for 95% of the buildings; ➤ BRD uses Planethic - an internal online tool, which measures indicators in 6 areas of interest for the environment and uses several measurement units; ➤ BRD is involved in social responsibility activities, in various areas such as: education, technology and innovation, culture, sports; ➤ BRD is the first bank in Romania evaluated by Sustainable Fitch, and following the evaluation it obtained an ESG rating of "3" and a score of 60.
ING Bank	<ul style="list-style-type: none"> ➤ ING Bank offers interest rate reductions on EcoLife mortgage loans; ➤ ING Bank became the sole financier of the Guarantee-Return System, supporting the project's activity; ➤ In order to streamline and digitize the donation process between individual clients and NGOs, ING Bank created the Doneaza in Home'Bank platform.
Raiffeisen Bank	<ul style="list-style-type: none"> ➤ 39% of the volume of real estate loans granted by Raiffeisen Bank in 2023 to individuals targeted buildings with energy class A; ➤ 20% of the financing granted to corporate clients supported green and social projects; ➤ Greenhouse gas emissions are down by 7.66% in 2023, compared to 2022; ➤ Raiffeisen Bank expanded its portfolio of bonds in a green and sustainable format, by issuing the first non-preferential senior euro bonds in a sustainable format, on the international capital market, with a total value of 300 million euros; ➤ It is involved in projects to support financial education in schools in Romania; ➤ 49 farmers participated in GreenFields Academy courses, with the aim of switching to sustainable agriculture; ➤ 77 employees participated in trainings designed to convey fundamental concepts regarding sustainability and ESG principles (environmental, social and governance); ➤ In 2023, there was a significant increase in the percentage of recycled PVC used in the production of new cards (20% in 2023 compared to approximately 1% in 2022); ➤ 41.79% of the total electricity consumed came from renewable sources.
Unicredit Bank	<ul style="list-style-type: none"> ➤ It financed businesses in the area of green energy, renewable energy and energy efficiency; ➤ It granted individuals the green loan with mortgage, to encourage the purchase of real estate with an Energy Performance Certificate in class "A"; ➤ Through the GoGreen project it encourages the purchase of electric and hybrid vehicles; ➤ It created a new facility to access a credit card 100% online, directly from the Mobile Banking application; ➤ It supported financial and entrepreneurial education programs in technical high schools, and offers students the opportunity to participate in internship programs.
Exim Banca Romaneasca	<ul style="list-style-type: none"> ➤ The digitization of some activities (electronic bank statements, card PINs via SMS, etc.) resulted in a decrease in paper consumption by 17.77 tons, compared to 2022; ➤ Classic lighting was replaced with lighting based on LED technology, which will bring an electricity saving of approximately 45 - 50% of the total energy consumed for lighting; ➤ Existing illuminated advertisements at the level of territorial units were replaced with LED illuminated advertisements; ➤ In order to reduce the carbon footprint, old thermal power plants were replaced at three units with new plants with higher energy performance; ➤ In 2023, the bank began the process of implementing physical cards made of recyclable materials, 100% green; ➤ The bank supported financial education projects in schools, implemented internship programs and also joined digital education campaigns carried out at the level of the banking system; ➤ A sponsored projects focused on providing support in the fields of culture, art, health care, science, sports, religious cults, fundamental and applied research, etc.

Alpha Bank Romania	<ul style="list-style-type: none"> ➤ Alpha Bank Romania pays special attention to energy-efficient mortgages, and in this regard, it has joined the "Energy Efficient Mortgage Label" certification system and is a member of the Romanian Green Building Council (RoGBC); ➤ The process of granting personal loans has been 100% digitalized; ➤ Through the process of carrying out social responsibility programs, it has supported the sectors: education, culture, art, sports.
OTP Bank Romania	<ul style="list-style-type: none"> ➤ OTP Bank Romania's ESG strategy is based on 3 strategic materiality pillars: responsible supplier, responsible employer, responsible social actor; ➤ Responsible supplier: In order to transition to the green economy, OTP Bank Romania wants to develop the green financing portfolio and ensure 100% digital channels for the main products and services, while maintaining full services in branches for less digital customers / with more complex requests; ➤ Responsible employer: aims at continuous investment actions in the well-being and permanent development of employees; ➤ Responsible social actor: by establishing ambitious objectives regarding environmental protection (reducing greenhouse gas emissions, purchasing electricity from renewable sources, using recycled paper and reducing paper consumption), involvement in various educational programs, supported by the OTP Bank Romania Foundation and supporting the community through volunteering and sponsorship actions.

Source: Author's projection based on banks' non-financial reports

The ESG actions presented above are based on information published by banks through several types of reports. Their structure is graphically represented below.

Figure no. 2 Number of non-financial reports depending on their type



Source: Author's projection

4. Findings

Following the analysis carried out, we can conclude that there is a desire for ESG reporting from banks in Romania, but at different levels. We consider the capital structure, size criteria, belonging to a group to be elements that influence the fence of involvement in ESG actions.

At the sector level, there are several trends regarding the types of ESG actions undertaken by banks:

- digitalization of internal activities, respectively of services offered to customers;
- introduction of green financing in the package of services offered to customers;
- orientation towards environmental protection, through recycling activities, reduction of consumption of non-renewable resources;
- provision of continuous training courses for employees;

- involvement in social responsibility activities in various fields.

Regarding the ESG reporting methods, banks choose to communicate through sustainability reports, annual reports, non-financial statements, and in some cases briefly publish certain information directly on the bank's website.

5. Conclusions

Although the development and implementation of an ESG strategy is complex and expensive (Purcarea, 2024), in the medium and long term it produces benefits and it is obvious that ESG represents the solution for the future of all businesses.

In the event of unpredictable economic and social fluctuations, the banking sector, being an important pillar for the economy, must be cautious and know its business model.

In the process of establishing the ESG strategy, banks have the opportunity to analyze and improve their activity.

The banks that manage these new challenges most effectively will win.

As a consequence of this, a 2024 study showed that the rate of non-performing loans in the Romanian banking sector decreased by 47% in September 2023 compared to 2018. (Tudorache, 2024)

One of the ESG actions common to most banks in the analyzed sample is green financing. By prioritizing this type of financing, Romanian banks not only promote a greener economy, but also position themselves as leaders in responsible banking practices. (Carbune, 2024)

In this research effort, a limitation was represented by the lack of uniformity in the type of report and their structure. At the same time, the large volume of information contained in a single report can complicate the communication process with stakeholders.

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The Relationship between Non-Financial Reporting Parameters and Financial Performance, a Literature Review

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Abstract

This literature review explores the intricate relationship between non-financial reporting parameters and financial performance. As stakeholders increasingly demand transparency and accountability, non-financial metrics such as environmental, social, and governance (ESG) factors have gained prominence. This review synthesizes existing research to understand how these parameters influence financial outcomes. Key findings suggest that robust non-financial reporting can enhance corporate reputation, investor confidence, and operational efficiency, ultimately leading to improved financial performance. However, the impact varies across industries and regions, highlighting the need for standardized reporting frameworks. This article contributes to the ongoing discourse by identifying gaps in current research and suggesting directions for future studies to better comprehend the dynamics between non-financial disclosures and financial success.

Key words: literature review, non-financial reporting, financial performance
J.E.L. classification: M14, G32, Q56, C83, L25

1. Introduction

The relationship between non-financial reporting and financial performance has emerged as a pivotal area of research in the corporate governance domain. Traditional financial metrics have long served as the cornerstone of corporate evaluation. However, recent studies highlight the significance of non-financial factors, such as ESG metrics, in shaping financial outcomes. Companies that excel in these areas often report enhanced reputations, stronger stakeholder relationships, and improved operational efficiencies. These benefits, in turn, contribute to superior financial results.

This article provides a systematic review of literature on the relationship between non-financial reporting and financial performance. By synthesizing prior research, it aims to uncover patterns, identify gaps, and offer insights into the mechanisms through which non-financial disclosures influence financial success. Additionally, the study aims to enhance the understanding of the value of non-financial reporting in the modern business environment and lay a foundation for future research.

2. Theoretical background

The literature review is anchored in the integrative SALSA (Search, Appraisal, Synthesis, Analysis) model, which provides a structured approach for conducting systematic reviews (Booth et al., 2016). The model encompasses four stages:

- Search: Formulating research questions, identifying appropriate databases and keywords, and developing a search strategy.
- Appraisal: Selecting and assessing the quality of the retrieved items.

- Synthesis: Employing techniques to consolidate findings into coherent themes.
- Analysis: Utilizing tools such as bibliometric analysis and data visualization to interpret results.

The SALSA framework ensures methodological rigor in evaluating the literature and identifying relevant trends and patterns. A cartographic and bibliometric analysis further supports this review, enabling the evaluation of a large body of work to assess the quantity and quality of findings in this domain. Bibliometrics, as a subfield of scientometrics, facilitates the statistical analysis of publications to identify key actors, cooperation structures, and thematic trends (van Eck & Waltman, 2011).

Table no.1 SALSA model description

SALSA	
Search	<ul style="list-style-type: none"> • Development of a research question • Protocol review • Identifying the appropriate databases and keywords • Development and documentation of the search strategy • Evaluating search results and adjusting search strategies
Appraisal	<ul style="list-style-type: none"> • Item selection and quality assessment
Synthesis	<ul style="list-style-type: none"> • Synthesis techniques
Analysis	<ul style="list-style-type: none"> • Analysis techniques; Bibliometric analysis • Data Mining and Quality Assessment Tools • Use tables and graphs for illustration

Source: Own processing according to the model described by Booth et al. (2016)

3. Research methodology

The research question guiding this review is: Is there a relationship between non-financial reporting and corporate performance?

To address this question, a systematic search was conducted using the Web of Science database. Keywords included combinations such as "non-financial disclosure," "non-financial reporting," "company performance," "emerging economies," and "econometrics." The search was refined to include only peer-reviewed articles, resulting in 460 relevant studies.

Bibliometric analysis using VOSviewer was employed to identify key themes, influential studies, and emerging trends. This tool enabled a comprehensive visualization of term co-occurrences, revealing clusters of interconnected themes related to non-financial reporting and financial performance.

4. Findings

The bibliometric analysis yielded three major thematic clusters:

Financial Performance and Economic Impact (Red Cluster): This cluster focuses on the economic implications of non-financial reporting. Terms such as "financial performance," "efficiency," "profitability," and "market value" dominate this cluster, highlighting the relationship between non-financial disclosures and traditional financial metrics.

Non-Financial Reporting Practices (Green Cluster): This group examines the management and implementation aspects of non-financial reporting. Key terms include "voluntary reporting," "sustainability issues," and "risk management," emphasizing how such practices contribute to corporate governance and sustainable development.

Environmental, Social, and Governance Factors (Blue Cluster): ESG dimensions form the core of this cluster. Terms like "transparency," "CSR," "stakeholders," and "climate change" underscore the broader societal and environmental responsibilities of corporations.

The central positioning of "non-financial disclosure" across all clusters indicates its pivotal role in integrating these themes. Larger node sizes and thicker connecting lines in the visualization reflect the prominence and interconnectedness of key terms.

5. Conclusions

This literature review underscores the significant influence of non-financial reporting parameters on financial performance. Using the SALSA model and bibliometric tools, the analysis reveals that ESG factors, CSR activities, and sustainability reporting enhance profitability, market valuation, and risk management. These findings advocate for the integration of non-financial disclosures into corporate strategies to achieve sustainable financial outcomes.

However, the review also highlights gaps in existing research, including the need for standardized reporting frameworks and sector-specific analyses. Future studies should explore the long-term impacts of non-financial reporting, refine measurement frameworks, and investigate regional variations to provide deeper insights into this evolving field.

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Optimizing Cash Flow

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Abstract

In a globalized world economy, it is increasingly difficult for an economic entity to meet its financing needs unless it has a substantial financial baggage. It must therefore secure this financial baggage either from internal or external sources. It should be taken into account when these sources are used because in both situations various costs are involved which may not be accessible to any economic entity, especially since sometimes the very activity of the economic entity involves high costs that must be covered. In the scientific approach we have presented a number of ways to optimize cash flow and we have presented in more detail two of them, each with advantages and disadvantages, factoring and outsourcing. There may be other ways in addition to what I have presented as ways of optimization.

Key words: cash flow, expenses, factoring, receivables, outsourcing

J.E.L. classification: D24, G32, M41

1. Introduction

Cash flow provides information about the money actually flowing into and out of a business over a given period of time. It effectively reveals a company's ability to generate cash and manage its current payments.

Cash flow is of three types, namely:

- Operational (from operating activities) - generated from the company's core activities;
- Investment - cash used or generated from the purchase and sale of long-term assets;
- Financing - cash obtained or utilized through external sources of financing.

Optimizing cash flow is essential to maintaining the financial health of a business and is achieved through several methods.

The main objective of this scientific approach is to identify the main methods of cash flow optimization.

The question may arise why is it imperative to optimize cash flow? The cash flow of an economic entity is very important because it underpins the activity of this entity, providing the necessary liquidity to carry out the activity. Liquidity is needed both to honor contracts for the purchase of goods, commodities, raw materials, etc., and for various payments within the entity such as salaries, rents for premises, utilities, etc. At the same time, taxes and duties owed to the state must also be paid.

2. Theoretical background

Effective cash flow management is an imperative for economic entities seeking to secure their financial needs. As a result, the identification and implementation of optimized cash flow strategies are essential to sustain business activity and minimize associated costs. The present study explores two main methods of cash flow optimization: factoring and outsourcing, each with specific advantages and disadvantages.

Factoring, a financing method whereby a company sells its uncollected invoices to a factor in exchange for an immediate advance of capital, is an efficient option for companies that require quick cash to support their current operations. Although factoring may incur additional costs, such as fees and interest, these can be justified by the quick access to capital and improved cash flow (Herciu *et al*, 2023, p.308).

On the other hand, outsourcing, the process of delegating non-core activities to third parties to focus on core competencies, can provide significant cost savings and improve operational efficiency. However, much depends on selecting the right suppliers and managing contractual relationships effectively (Abu Elnasr, Etman and Sanad, 2022, p.133).

These strategies, although effective, are not universal and require careful consideration of the specific context and needs of each economic entity (Brasoveanu, 2023a, p.56; 2023b, p.46). For example, Aivaz and Avram (2021, p.475) emphasize the importance of assessing the financial performance of companies before choosing a cash flow optimization strategy, arguing that the economic and sectoral context can significantly influence the effectiveness of these methods.

It is also important to consider the impact of these strategies on the business model and long-term sustainability. Matei and Aivaz (2023, p.978) explore how asset compliance in financial reporting can influence cash flow optimization decisions, highlighting the need for increased transparency and rigor in financial valuation.

Cash flow optimization is thus a necessity adapted to complex global market conditions. Factoring and outsourcing, as optimization strategies, need to be assessed according to the specifics and needs of each company, considering the internal and external factors that may influence their effectiveness. Successful implementation of these strategies requires a deep understanding of financial mechanisms and continuous adaptation to economic dynamics (Munteanu *et al*, 2023, p.203).

Continuing the discussion on optimizing cash flow across sectors, it is essential to understand the impact of regulatory compliance and non-compliance on companies' financial performance. Research in recent years (Chiriac, Munteanu and Aivaz, 2022, p.298; Aivaz *et al*, 2022, p.4) explores the financial implications of noncompliance in transportation businesses, highlighting how noncompliance can generate significant costs that negatively affect cash flow. These costs can range from fines and penalties to lost revenue due to business interruption.

In addition to compliance issues, investments in sectors such as agriculture, forestry and fisheries play a crucial role in optimizing cash flows across economic agents. Agu *et al* (2024, p.37) examines the dynamics of the level of investment in these sectors, highlighting how strategic investments can contribute to coastal development and improve overall economic performance.

In the context of the COVID-19 pandemic, the HoReCa sector has been severely affected, and Aivaz and Capatana's (2021, p.289) analysis of the asset returns of companies in this sector in Constanța County provides valuable insights on post-shock recovery. They highlight the importance of effective asset management to maximize profitability and stabilize cash flows in times of uncertainty.

Moreover, Aivaz (2021, p.31) investigates the impact of subsidy revenues on turnover for agriculture, forestry and fisheries companies in the Black Sea coastal zone, highlighting the role of subsidies in supporting liquidity and financial optimization of these entities. It emphasizes how critical these external revenue streams are for financial sustainability in capital-intensive sectors.

Similarly, Aivaz *et al* (2019, p.115) discuss the commercial profitability of companies in the coastal localities of Tulcea County, emphasizing the importance of asset management and the correlations between assets and turnover. These correlations are essential for strategic financial planning and continuous cash flow optimization in specific geographical regions.

Therefore, the application of financial optimization methods needs to be tailored to regional and sector specificities, recognizing the variability of market conditions and the need for a flexible and informed approach to cash flow management.

In today's economy there is an increasing emphasis on the need for liquidity even though most transactions are done through banking instruments. Payments to suppliers of products and/or services have to be made, but in order to do so, an economic entity needs to be liquid.

The issue of cash flow arises all the time because there are situations when, in theory, an economic entity has cash, but in practice it is tied up in assets or in receivables. And it is precisely here that it is imperative that the entity's management "works" to ensure that the cash flow is certain and liquid.

An example is shown in Table 1.

Table no. 1. Cash flows situation

Item name	Financial year	
	N	N+1
Cash flows from operating activities:		
Receipts from customers	286.054,00	188.536,00
Payments to suppliers and employees	240.544,00	150.120,00
Interest paid	0,00	0,00
Income tax paid	92.998,00	6.450,00
Receipts from earthquake insurance	0,00	0,00
Net cash from operating activities	-47.488,00	31.966,00
Cash flows from investing activities:		
Share purchase payments	0,00	0,00
Payments for the acquisition of tangible fixed assets	69.690,00	0,00
Proceeds from the sale of tangible real estate	0,00	0,00
Interest collected	27.029,00	9.396,00
Embedded dividends	0,00	0,00
Net cash from investing activities	-42.661,00	9.396,00
Cash flows from financing activities:		
Proceeds from the issue of shares	0,00	0,00
Loan receipts	2.500,00	3.000,00
Loan repayments	2.500,00	3.000,00
Dividends paid	102.560,00	349.180,00
Net cash from financing activities	-102.560,00	-349.180,00
Net increase in cash and cash equivalents	-192.709,00	-307.818,00
Cash and cash equivalents at the beginning of the financial year	600.562,00	407.853,00
Cash and cash equivalents at the end of the financial year	407.853,00	100.035,00

Source: Author's processing

It is easy to see that the three types of cash flows play an important role in determining the cash and cash equivalent position at the end of a financial year.

3. Research methodology

In this research, we delve into the intricate processes of optimizing cash flow within economic entities, recognizing its important role in sustaining financial health and ensuring operational continuity. The primary focus of our study is to explore and articulate the various strategies that businesses employ to manage their cash flows effectively, with an emphasis on how these strategies impact their overall financial stability and efficiency.

The methodology of this research is anchored in a qualitative approach, combining an extensive literature review with a detailed analysis of case studies. Through the literature review, we engage with a broad spectrum of existing academic and industry insights on cash flow management techniques. This comprehensive examination highlights the nuanced benefits and challenges associated with prominent strategies like factoring and outsourcing.

Factoring emerges as a strategy where businesses sell their outstanding invoices to a third party at a discount to gain immediate liquidity. This method proves especially beneficial for entities requiring quick access to cash to maintain their operational flow. However, the associated costs, such as fees and interest rates, demand careful consideration against the immediate financial relief it provides.

Outsourcing, on the other hand, involves delegating non-core functions to external experts, allowing businesses to concentrate their efforts and resources on their primary activities. This strategy can lead to substantial cost savings and operational efficiencies. The effectiveness of outsourcing, however, hinges on the ability of the company to select the right partners and manage these relationships effectively, ensuring that the outsourced services align with the company's strategic goals and quality standards.

The data collection for this study involves a thorough review of scholarly articles, industry reports, and case histories that detail the implementation and results of different cash flow management strategies. This eclectic data gathering enables us to identify prevailing trends and draw significant correlations between the success of specific strategies and the conditions under which they are employed.

Through careful analysis, we synthesize the gathered data to uncover the circumstances that favor cash flow strategies over others (Rus, 2022, p.1012). We look at variables such as the size of the company, the industry in which it operates, and prevailing market conditions to determine the effectiveness of each strategy.

The insights gained from this study are intended to deepen the understanding of cash flow management, providing valuable guidance to business leaders and financial managers. By elucidating the advantages and limitations of various cash flow optimization strategies, this research aids in making informed decisions that bolster a company's liquidity, ensuring its capability to fulfill immediate financial obligations and to plan strategically for future growth.

In essence, our research methodology not only captures the complexity of financial management in contemporary business environments but also contributes meaningfully to the discourse on sustainable economic practices. Through this detailed exploration of cash flow optimization techniques, we offer a nuanced perspective on financial management that is critical for any business navigating the challenges of today's economic landscape.

4. Findings. Ways to optimize cash flow

Improving debt collection - this involves reducing payment terms, which involves negotiating shorter payment terms with customers, prompt invoicing, i.e. sending invoices immediately after delivery of goods or services, tracking overdue payments, i.e. it involves an automated system of notifications for late payments, as well as offering incentives, giving discounts for early payments.

Managing payments to suppliers - involves negotiating payment terms, extending payment terms without affecting supplier relationships, payment in installments (installments), especially where this is possible, and strengthening relationships with suppliers, to obtain more favorable terms of payment and delivery of products or services.

Inventory optimization - involves avoiding overstocking, by monitoring stock levels to avoid cash being tied up in stocks, implementing sourcing strategies to reduce stock holding times and continuous analysis of demand by using forecasting in procurement planning.

Expense control - consists in reducing fixed and variable costs, which can be achieved by identifying expenses that can be eliminated or reduced, automating processes by making investments that reduce operating costs, and outsourcing, i.e. outsourcing activities that are not essential to the business of an economic entity.

Revenue maximization - is based on diversifying revenue sources by introducing new products or services to attract new and more customers, increasing prices by moderately adjusting prices where possible, and a customer retention strategy that requires building long-term relationships to ensure recurring revenues.

Planning and forecasting - analyzing cash flow, requires monthly projections to anticipate cash needs, the establishment of an emergency fund, i.e. reserves for unforeseeable situations, and the use of software tools, i.e. financial management applications to monitor the business entity's activity as closely as possible.

Accessing sources of finance - consists in accessing lines of credit, accessing lines of credit to cover liquidity needs in periods of deficit, factoring, by selling receivables to obtain liquidity, or calling on investors, both internal (shareholders, associates) and external, when a capital infusion is needed.

In what follows, I will present two lesser-known sources of financing: factoring and outsourcing.

Factoring is a financial process whereby a company sells its trade receivables, in this case invoices receivable, to another entity called a factor in exchange for immediate cash. This is a way for companies to get quick cash without waiting for customers to pay.

The document cycle is as follows: the business entity issues an invoice to the customer for goods or services delivered, the invoice is sold to a factoring company, the factoring company pays a portion of the invoice amount, ranging from 70% to 90% of the invoice amount, and after the customer pays the invoice to the factoring company, the factoring company transfers the balance of the invoice amount to the business entity, less a factoring fee contractually agreed upon.

Factoring has both advantages and disadvantages. Advantages include an improvement in cash flow, so that economic entities can access liquidity immediately, the risk of default decreases because in non-recourse factoring the risk is the factoring company's, and at the same time, it greatly simplifies the management of receivables. The disadvantages include high costs, since factoring fees are not low and are often a percentage of the value of the receivables to be recovered, economic entities may become dependent on such a mechanism for obtaining liquidity and, last but not least, the repeated use of factoring companies may lead to a deterioration over time in relations with some customers.

Factoring is a useful solution especially for small and medium-sized companies that need quick access to capital and work with long payment terms.

Outsourcing is the process by which a company outsources certain activities, processes or services to another specialized firm instead of performing them in-house. The main purpose of outsourcing is to reduce costs, increase efficiency or access specialized expertise.

Like factoring, outsourcing has advantages and disadvantages. Advantages include cost reduction, i.e. companies can save money by avoiding investments in equipment, infrastructure or staff training; access to expertise, i.e. access to professionals with experience or advanced technology; focus on core activities, i.e. freeing up internal resources to concentrate on core competencies; operational flexibility, which allows scaling resources according to needs; and a reduction in time to market, which means that outsourcing to specialists can speed up the processes of launching products on a new market (Adjei et al., 2019, p.38; Abdel-Raheem, 2013, p.245).

Examples of activities that are usually outsourced are IT services, human resources (recruitment, payroll administration), support services (call center or customer service), production of components or marketing for advertising campaigns.

5. Conclusions

Cash flow optimization is an ongoing process that requires regular monitoring and proactive adjustments. Implementing these strategies can ensure financial stability and sustainable business growth.

An economic entity always needs cash to conduct its business, regardless of the area of activity. If this is not available internally, then the entity has to turn to external sources of liquidity, which seems natural at some point in time, especially when it wants to expand the market in which to operate.

At the same time, however, the use of external sources also comes with some risks that may arise, such as market risks, operational risks, etc., which is why liquidity indicators must be closely monitored to avoid undesirable situations where the entity may end up heading towards bankruptcy.

It is desirable to draw on internal sources to meet cash flow needs and to make investments when the entity is found to have a cash surplus.

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Impact of Turnover on Cash Flow

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Abstract

Cash flow is very important in the activity of an economic entity, as the very existence of that entity depends on it. The greater the amount of cash flow available to the entity's management, the more it can be used to expand the business or at least to maintain the entity's operations. An increase in turnover is one way of increasing cash flow and has a large influence on its value. But it should not be forgotten that uncontrolled turnover growth without proper management can generate financial pressures. In the scientific approach I have tried to show how turnover can influence cash flow, I have presented the financial risk that can influence turnover and I have determined that good financial planning can lead to an increase in turnover.

Key words: cash flow, turnover, financial risk, financial planning, budget, financial risk

J.E.L. classification: D24, G32, M41

1. Introduction

In the activity of an economic entity there may be problems with cash flow, which decreases for various reasons (collection of receivables at longer periods of time, price increases for products and/or services, etc.), but this may also be due to a decrease in turnover.

The decline in turnover has many causes, including inflation, decreasing purchasing power, increased competition, economic and political uncertainty, etc. Therefore, economic entities need to be prudent in their future estimates for sales, cost and profit budgeting and take into account more pessimistic estimates and scenarios (lower sales, delayed receipts, etc.) and estimate the impact of these variables on profit and cash flow.

The objective of this scientific endeavor is to trace how turnover can influence cash flow and also the financial risk to which an economic entity is subject when a decrease in cash flow occurs, which can have consequences that can lead to the insolvency of the economic entity.

2. Theoretical background

Cash flow is a vital component in the activity of any economic entity and is fundamental to its survival and development. According to this study, turnover growth appears to be an effective means of boosting cash flow, significantly influencing its value. However, it is essential to realize that uncontrolled turnover growth without proper management can generate considerable financial pressures (Aivaz, 2021a, p.54).

The literature suggests that there is a direct and complex relationship between turnover and cash flow, influenced by multiple financial and non-financial variables. Aivaz (2021b, p.32) highlights the impact that subsidy revenues can have on turnover in sectors such as agriculture, forestry and fisheries, signaling a positive correlation between these revenues and turnover growth. This, in turn, can lead to improved cash flow, conditional, however, on rigorous financial planning and prudent resource management (Aivaz et al, 2019, p. 116).

Financial risk, on the other hand, is a determining factor in the dynamics of turnover and, consequently, cash flow. Aivaz *et al* (2022, p.3) explore the links between transportation nonconformities and financial uncertainty in the context of the COVID-19 pandemic and armed

conflicts, demonstrating how external uncertainties can negatively influence financial performance. Financial planning thus becomes a central tool in mitigating risks and supporting sustainable turnover growth with direct effects on cash flow.

The legislative and institutional context also plays a significant role in shaping economic behaviors and promoting sustainable development, which in turn affects the financial performance of entities. Brasoveanu (2023a, p.52; 2023b, p.44) discusses the impact of regional development on the environment and the role of legislation in supporting sustainable development, which also indirectly influence the financial performance of companies.

In conclusion, turnover growth can have a positive impact on cash flow, but this effect is conditional on the ability of entities to effectively manage financial risks and adapt to changing market and regulatory conditions (Aivaz, 2021c, p.18). Thus, financial success is dependent not only on internal management factors but also on a favorable and stable external environment (Munteanu *et al*, 2023; Stroie *et al*, 2023).

Turnover growth and its impact on cash flow is a complex topic that involves the assessment of many financial variables (Stan, 2021, p.227). Among them, the receivables turnover ratio and its impact on profitability was studied in detail by Afi and Falih (2024), who identified a significant correlation between receivables turnover ratio, cash turnover ratio and return on assets.

Also, the relationship between free cash flow and profitability was explored by Ahmed *et al* (2018), who observed that free cash flow has a positive impact on profitability in the pharmaceutical sector. This suggests that effective cash flow management can play a crucial role in improving the financial performance of a company.

In addition, the link between capital structure and financial performance is illustrated in the study by Affandi, Sunarko and Yunanto (2019), who analyzed the impact of various financial ratios such as cash ratio, debt to equity and debt turnover ratio on dividend payout ratio. Their results emphasize the importance of a balanced capital structure to support a generous dividend policy.

In the context of leadership changes, Adams and Mansi (2009, p.524) investigate the impact of CEO changes on the wealth of bond lenders, emphasizing that these changes can have significant effects on stakeholder value, including bond lenders. The interdependence between management decisions and the financial performance of companies is also demonstrated (Stan and Vintila, 2021, p.172).

Therefore, it is essential for managers to understand and integrate these various financial influences into their strategies to optimize financial performance and support the long-term sustainable growth of companies.

Today's highly globalized economy was flooded with liquidity during the period of the covid epidemic by all countries, which subsequently started to withdraw money supply from the market in order to limit the effects of excess inflation. In an attempt to limit the effects of high inflation, this money supply started to be withdrawn from the market and, as a result, some economies started to experience liquidity problems.

In order to avoid financial bottlenecks, economic entities have started to apply some measures to avoid default, which is not beneficial at all. That is why they have started to apply a number of measures in order to have liquidity. One of the measures has been to increase turnover which, theoretically, should provide a cash flow surplus, a surplus that can be the basis for expanding the business or at least keeping the business afloat.

This is why I have tried in this scientific endeavor to show how turnover influences the activity of an economic entity, especially since turnover is a very important indicator in the "healthy" activity of an economic entity.

3. Research methodology

In the methodology of our study, we employed the analytical research method, a critical approach aimed at uncovering detailed insights into specific topics. This method involves a systematic collection and examination of data to evaluate hypotheses or reinforce particular viewpoints. Initially, relevant data pertaining to the topic were gathered. Subsequently, this data underwent rigorous analysis to substantiate the ongoing research, enhance its credibility, and potentially spark new perspectives regarding the subject matter.

A significant component of our analytical approach was the comprehensive review of existing literature, which involved scrutinizing previously accumulated data related to our field of study (Brasoveanu, 2023, 56). This step is crucial as it helps in building a solid foundation for the research by integrating and reevaluating existing knowledge.

One important characteristic of the analytical research method is its adaptability in the face of new information. Unlike other methodologies, such as experimental research that can establish causality and thus provide robust evidence regarding the origins of a phenomenon, the analytical approach is inherently limited by the availability and completeness of data. This inherent limitation means that conclusions drawn from analytical methods are provisional and subject to adjustment with the acquisition of new or more comprehensive data (Rus, 2022, 1012).

Thus, the analytical method not only supports the validation of current research but also remains flexible enough to incorporate emerging data, making it a dynamic tool in the arsenal of scientific methods. This flexibility is critical, especially in fields where data is continuously evolving and expanding, allowing for ongoing refinement and enhancement of research outcomes.

4. Findings

4.1. Financial risks

Riscul financiar în cadrul unei entități economice reprezintă probabilitatea ca acea entitate să nu poată face față obligațiilor sale financiare, ceea ce poate duce la pierderi financiare, afectarea reputației sau chiar insolvență. Acest risc apare din diverse surse și este influențat de deciziile de finanțare, structurarea datoriilor și gestionarea fluxurilor de numerar.

Several types of financial risk are present in practice: liquidity risk, which arises when the economic entity does not have sufficient cash or liquid assets to cover its current obligations (inability to pay suppliers or employees on time), credit risk, which is that risk when the economic entity cannot repay debts incurred or has difficulty in obtaining financing (default on a line of credit), interest rate risk, which arises when fluctuations in interest rates can increase the cost of financing loans or lines of credit (rising interest on a mortgage loan affects profitability), currency risk, which is the type of risk that affects entities operating internationally or that have revenues and expenses in different currencies (the depreciation of a currency may increase the costs of imports) and operational risk with financial impact, which is the type of risk where losses may occur as a result of faulty internal processes, human error or external factors, affecting financial stability (an industrial accident may lead to significant losses).

Financial risk can be managed in the following ways:

- Diversification of funding sources - combining equity and debt financing to reduce reliance on a single source;
- Periodic cash flow analysis - careful planning of cash inflows and outflows to ensure liquidity;
- Hedging for currency and interest rate risk - the use of forwards, swaps or options to protect the firm from adverse fluctuations;
- Reducing excessive debt - maintaining a healthy equity to debt ratio;
- Building a reserve fund - liquid "wealth" for contingencies or financial crises, and
- Monitoring financial indicators - tracking indicators such as leverage, current liquidity or interest cover to detect potential problems early.

4.2. Impact of turnover on cash flow

Turnover is the total amount of sales made by a company in a given period. It has a significant impact on the economic entity's cash flow, which is the difference between cash receipts and cash payments.

Some of the ways in which turnover can influence cash flow are:

- Increased turnover - has a positive impact because higher turnover indicates higher sales volume, which can lead to higher cash receipts, improving cash flow, and these cash receipts need to occur in a short time frame to avoid cash bottlenecks;
- Link to payment terms - if an increase in turnover implies longer payment terms to customers, cash flow may become negative as the economic entity has to finance operating costs upfront and outstanding receivables may reduce cash flow even if turnover is high;
- Costs associated with sales - higher turnover can come with increased operating costs (raw materials, salaries, marketing, etc.), which can put pressure on cash flow; ineffective inventory or expense management can magnify this impact;
- Seasonality effect - in seasonal businesses, a sudden increase in turnover in a particular period can lead to cash imbalances, e.g. if receipts occur after the revenue-generating season, the economic entity needs to have sufficient cash reserves to cover current payments;
- Financing strategies - sometimes, economic entities may invest in business growth by extending credit to customers or by increasing marketing expenditures. This can temporarily lead to negative cash flow.

To optimize cash flow based on turnover I can make the following recommendations:

- Monitor receivables - track overdue payments and implement strict collection policies;
- Reduce payment terms - negotiate shorter terms for collections from customers;
- Inventory management - optimizing inventory to avoid tying up capital;
- Financial planning - creating a cash budget to anticipate seasonal fluctuations.

Financial planning is an essential process for ensuring effective management of financial resources, achieving strategic objectives and increasing long-term sustainability. It involves financial forecasting, efficient allocation of resources and continuous monitoring of economic performance.

The main stages of financial planning are:

- ❖ Setting financial objectives - consists of clearly defining short, medium and long term strategic objectives, i.e. increasing revenues, reducing costs, diversifying sources of income, investing in assets;
- ❖ Analysis of the current financial situation - consists of assessing available financial resources (cash, assets, liabilities), analyzing key financial indicators (profitability, liquidity, solvency, profitability) and identifying financial strengths and risks;
- ❖ Budgeting - consists of creating an annual budget reflecting operational and strategic plans and dividing it into categories such as: anticipated revenues, operating expenses (direct and indirect costs) and capital expenditures (investments in equipment, technology, etc.);
- ❖ Financial forecasting - consists of estimating future income and expenditure based on historical data and market trends and using scenarios to assess the impact of economic changes (optimistic, pessimistic, realistic scenarios);
- ❖ Allocation of financial resources - requires prioritizing investments according to expected returns and strategic objectives and maintaining a balance between operational expenditure and capital investment;
- ❖ Monitoring and Adjustment - consists of periodically analyzing financial performance against budget and targets, identifying deviations and taking corrective action, and redesigning the financial plan in line with economic and market conditions.

Good financial planning also has benefits such as **ensuring financial sustainability** because the economic entity avoids financial bottlenecks and optimizes the use of resources, **informed decision-making**, i.e. investment and spending decisions are based on sound analysis, risk prevention by **identifying and managing financial risks** before they affect the entity, and **increased investor and creditor confidence** because rigorous planning demonstrates that the entity is well managed.

Well-established financial planning that adheres to these steps and tools can only contribute to the success of a business entity, regardless of its size or scope of activity.

5. Conclusions

Turnover greatly influences the cash flow because, if other factors are taken into account, such as a decrease in operating expenses through technologization, re-engineering or outsourcing of certain processes in the economic entity's activity, then this increase in turnover generates additional cash flow and, last but not least, leads to an increase in the profitability of the economic entity.

An increase in turnover that is directly proportional to an increase in expenditure does not bring added value to the economic entity and account must also be taken of market factors that cause an artificial increase in turnover, such as inflation, increases in utility tariffs, increases in salaries, the price of raw materials, etc. This is why it is advisable to use, where possible, the scenario method mentioned above when establishing the prices of goods and/or services of the economic entity. Last but not least, the best possible recovery of receivables from customers.

In conclusion, turnover influences cash flow according to the speed of collection of receipts, the level of associated costs and the financing strategies used. Uncontrolled turnover growth without proper management of these factors can generate significant financial pressures.

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Mapping the Financial Performance of the Pharmaceutical Businesses in Romania

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Abstract

This study assesses the financial performance of firms in the pharmaceutical industry in Romania, with a focus on companies engaged in pharmaceutical wholesaling, according to CAEN code 4646. The main objective was to assess the economic level of this vital sector for the national economy, by analyzing financial indicators such as net turnover, net profit, personnel expenses and average number of employees. The analysis was carried out at territorial level, for each county, and according to categories of taxpayers. The data used in the study come from a sample of 1,164 firms selected based on the declared CAEN code. The results show a significant polarization, both territorially and by taxpayer size: large taxpayers generate the majority of turnover and profit, while small firms predominate in terms of numbers but operate on a small scale. The findings of the study underline the need to develop economic policies that support the balanced development of the pharmaceutical sector and boost long-term competitiveness.

Key words: pharmaceutical industry, financial performance, business strategies, Classification of Activities in the National Economy (NACE)

J.E.L. classification: I15, I18

1. Introduction

The pharmaceutical industry is one of the most dynamic and essential sectors of the economy, with a direct impact on the health and quality of life of the population. In the context of globalization and rapid economic change, the analysis of the financial performance of businesses in this industry becomes a necessity for understanding how companies contribute to economic and social development. In Romania, the pharmaceutical sector is of strategic importance, being both an engine of economic growth and a key element in ensuring the sustainability of the healthcare system.

The present paper focuses on mapping the financial performance of companies in the pharmaceutical industry in Romania, using a set of relevant indicators: turnover, profit, personnel expenses and average number of employees. These indicators allow a comprehensive and detailed analysis of how firms in this sector manage their resources and generate economic value. By aggregating data from all firms in the sector, the analysis provides a comprehensive picture of financial performance at national level.

The aim is to identify the trends and challenges faced by pharmaceutical companies in Romania, thus contributing to the foundation of economic policies and business strategies that support the sustainable development of the sector. At the same time, the paper aims to highlight the link between financial performance and the dynamics of the pharmaceutical market, emphasizing the role of this sector in the context of the national economy.

2. Literature review

The financial performance of companies in the pharmaceutical industry is influenced by several internal and external factors, such as intellectual capital, advertising effectiveness, financial risks, innovation strategy and local market specificity (Béresné Mártha, Tömöri & Lakatos, 2021;

Montalban & Sakinç, 2013). Studies in the literature contribute to the understanding of these issues and provide a useful comparative framework for the analysis of the Romanian pharmaceutical industry.

Research by Kusumawardhani (2012) emphasizes the role of intellectual capital in increasing profitability and productivity in the Indonesian pharmaceutical industry. This link is also highly relevant in the context of Romania, where the development of human capital and research and development (R&D) skills is a key driver of financial growth (Rus, 2018; Rus 2023). Complementarily, Rahman et al. (2020) explores advertising effectiveness as a determinant of profitability, highlighting the importance of a well-calibrated marketing strategy. These issues are particularly relevant in Romania, where the positioning of pharmaceutical brands can significantly influence financial performance.

Regarding the specific determinants of profitability, Tyagi and Nauriyal's (2017) study of the Indian pharmaceutical industry highlights the role of firm size, cost structure and innovation. These findings resonate with the realities of the Romanian pharmaceutical industry, where differences in scale and the degree of technological innovation directly influence economic performance. Similarly, several authors on the productivity crisis in the global pharmaceutical industry have emphasized the need for constant investments in R&D to maintain competitiveness, an essential aspect also for Romanian companies (Cockburn, 2006; Toma, 2020; Tömöri, Lakatos & Mártha, 2021; Tyagi & Nauriyal, 2016).

The link between innovation and profitability is also reinforced by Ken et al. (2008), who analyze the effect of patent lag on financial gains. In an industry characterized by long product development cycles, including in Romania, patents and innovation protection strategies are key to financial success. In the same register, Kounnou and Kyrkilis (2020) explore research and development (R&D) intensity as a driver of competitiveness and profitability in the Greek pharmaceutical industry, highlighting the importance of investing in innovation to remain relevant in a globalized market.

In addition, financial risks and their impact on profitability are analyzed by Tömöri et al. (2021), who demonstrate that a prudent approach to financial risk management can improve firms' economic performance. This observation is applicable to the pharmaceutical industry in Romania, where economic instability can influence firms' strategic decisions. Research by Fenyves et al. (2019) on the profitability of pharmaceutical companies in Visegrád countries provides a comparative basis to understand Romania's positioning in the regional context.

The studies by Montalban and Sakinç (2013) highlight the phenomenon of financialization of the pharmaceutical industry, suggesting that excessive orientation towards quick profits can negatively affect productive models. These conclusions are essential for Romanian companies, where a balance between profitability and long-term sustainability is needed. In the same perspective, the analysis of Stănică et al. (2015) on the profitability of the pharmaceutical industry in Romania provides important insights for understanding the local factors that determine economic performance.

The analysis of financial performance in the pharmaceutical industry in Romania can be better understood through the prism of recent research in related fields, which provide complementary insights and applicable methods. The study by Aivaz et al. (2023) highlights the impact of economic sanctions on financial indicators in the transportation sector. Using a discriminant model, the research demonstrates how external factors such as sanctions influence key variables such as turnover and profit. This approach can be extended to the pharmaceutical industry, where international market fluctuations and strict regulations play a similar role.

At the same time, Munteanu, Ionescu-Feleagă and Ionescu (2024), explore financial strategies to support the circular economy, a concept that can provide practical solutions for efficient resource management in the pharmaceutical sector. Circular economy principles are relevant in this context, given the need to minimize costs and optimize the use of materials. In this direction, research coordinated by Herciu, and his team (2023) proposes improved business models to support sustainability. Applying such a framework in the pharmaceutical industry can help reduce waste and increase competitiveness.

The importance of strategic reorganization is also highlighted by Stroie et al. (2023), who propose a risk analysis model for reorganization decisions. This approach is highly relevant for pharmaceutical companies facing economic pressures and the need to remain competitive in a changing market. In addition, Aivaz, in its 2021 paper, explores the relationship between infrastructure, medical staffing and financial indicators, revealing that investments in human resources and infrastructure can have a direct impact on financial performance. This is particularly significant for the pharmaceutical industry, where skilled staff and modern facilities are essential for success.

Furthermore, the dynamics of economic performance and its link to factors such as education and governance are highlighted by Munteanu et al. in 2024, analyzing the perception of corruption in the Schengen area. These results provide a basis for understanding how transparency and quality of governance can directly influence the sustainability and success of pharmaceutical companies. Furthermore, research conducted by Vancea and his team in 2024 (Vancea, Aivaz & Spiru, 2024; Vancea et al., 2024) on quality of life and medical rehabilitation methods emphasizes the importance of improving functional capabilities to support an integrated and efficient health system.

By integrating these perspectives, the analysis of financial performance in the Romanian pharmaceutical industry becomes not only an assessment of traditional economic indicators, but also an exploration of broader aspects such as sustainability, governance and strategic innovation (Ali, 2021; Stroie et al., 2023). This integrated framework contributes to a deeper understanding of how pharmaceutical companies can maximize their economic potential and meet the demands of an evolving market.

By integrating these studies, research on mapping financial performance in the Romanian pharmaceutical industry can benefit from a comprehensive framework linking global perspectives and local realities. The proposed multidimensional approach allows not only the identification of current trends, but also the formulation of strategies to support the sustainable development of this essential sector.

3. Research methodology

This study aimed at analyzing the financial performance of firms in the pharmaceutical industry in Romania, having as their object of activity the wholesale trade of pharmaceutical products, according to the NACE code 4646. The research was carried out through a detailed statistical analysis using SPSS version 28 software, which allowed the rigorous selection and processing of the relevant data. The choice of NACE code 4646 was essential to ensure an exclusive focus on the relevant firms in this specific sector. The database used included financial and operational information on 1,164 firms as of 2023, providing an overview of economic activity in this sector. The indicators analyzed - net turnover, net profit, personnel expenses and average number of employees - were selected to provide a comprehensive perspective on the financial and structural performance of the companies. Data were collected from official sources and verified to ensure accuracy and relevance.

The analysis involved several key steps. First, the data were processed to eliminate any inconsistencies and to ensure that all information was accurate and complete. Next, firms were classified by county and into three main categories of taxpayers - large, medium and small taxpayers - based on economic size and financial indicators. This categorization was used to facilitate the interpretation of differences and variations in performance.

SPSS was used to generate descriptive statistics and comparative analysis, which allowed a detailed understanding of the distribution of indicators at the national level and by taxpayer category. Measures of central tendency (mean) and variance (standard deviation) were calculated, as well as kurtosis and skewness indicators.

4. Findings

Figure 1 provides an overview of the distribution of firms engaged in pharmaceutical wholesaling in the counties of Romania. With a total of 1,164 firms nationwide, the data reflect significant differences between counties in the presence of this type of economic activity.

Bucharest stands out with an impressive 535 firms, accounting for almost half of all companies in this sector (about 46%). This concentration underlines the capital's role as a central hub for the distribution and trade of pharmaceuticals, benefiting from an advanced logistical infrastructure, access to large markets and proximity to the headquarters of many companies.

Other counties with a significant number of firms are Ilfov (101 firms), Cluj (68 firms), Iași and Timiș (56 firms each). These counties are important economic centers, characterized by a large population, strong medical institutions and high demand for pharmaceuticals. At the opposite pole, counties such as Caraș-Severin (0 firms), Harghita, Ialomița, Mehedinți and Tulcea (one firm each) have a low or non-existent presence of firms in this sector. This may indicate a combination of lack of infrastructure, low demand in these areas and different economic priorities.

Figure no. 1 The distribution of firms engaged in pharmaceutical wholesaling in the counties of Romania



Source: Author's own processing

Regions with a higher economic development (such as Bucharest-Ilfov, North-West and West) tend to concentrate a higher number of firms, due to higher demand for pharmaceutical services as well as more developed infrastructure. On the other hand, counties in less developed regions (South-West Oltenia, South-East) show lower values, reflecting an unequal concentration of economic activities. Counties such as Cluj, Iași, Brașov and Timiș, which are important university centers, have a higher presence of pharmaceutical firms. This can be associated with the training and attraction of pharmaceutical specialists, as well as easier access to scientific and medical resources. Many counties register fewer than 10 firms, indicating a modest distribution of this type of activity in less populated or less developed areas. Counties such as Alba, Gorj, Sălaj and Vaslui have only a few active firms, suggesting a possible dependence on larger regional centers.

This unequal distribution raises questions about equitable access to pharmaceuticals in less developed regions. The lack of firms in certain counties may indicate a potential vulnerability in the supply chain, especially in emergency or pandemic situations.

The distribution of firms active in pharmaceutical wholesaling in Romania is strongly influenced by factors such as the level of economic development, infrastructure, population and regional demand. Although there are strongly consolidated centers, such as Bucharest and Ilfov, there are also areas where the presence of this type of activity is minimal or absent, highlighting the need for policies to support the uniform development of the pharmaceutical sector at the national level.

Table 1 provides a statistical analysis of four financial and operational indicators for the 1,164 firms in Romania operating in the pharmaceutical wholesaling sector: net turnover (Net Turnover), net profit (Net Profit), personnel costs (Personnel Expenditures) and average number of employees (Average Number of Employees). The analysis highlights the central characteristics (mean), the variances (standard deviation) and the distribution (kurtosis and skewness) of these indicators.

Table no. 1 Statistical analysis of the financial and operational indicators

	Net Turnover	Net Profit	Personnel Expenditures	Average Number of Employees
Mean	46766656.63	2157472.35	2082896.98	16.81
N	1164	1164	1164	1164
Std. Deviation	314277534.908	10177833.335	8858718.305	72.366
Kurtosis	244.342	335.693	118.152	239.569
Skewness	14.761	16.194	9.736	13.699

Source: Author's own processing

The average net turnover is about 46.7 million lei per firm, while the average net profit is about 2.16 million lei. These values reflect a profitable industry, but with significant dispersion between companies. The average personnel costs are RON 2.08 million and the average number of employees is 16.81 per firm, suggesting a reasonable relationship between personnel costs and the size of the organization. The high standard deviation on all four indicators indicates large differences between firms. Net turnover varies significantly between firms, with a standard deviation of over RON 314 million, indicating the presence of very large firms influencing distribution. Similarly, net profit shows a high variation (RON 10.17 million), indicating marked differences in the financial performance of firms in this sector.

Personnel expenses and the average number of employees also show a considerable variation, indicating differences in staff structure and management strategies between companies. This high dispersion suggests the existence of both small and medium-sized companies as well as large organizations dominating the market.

The high kurtosis and skewness values indicate that the distributions are highly skewed and concentrated. The kurtosis of 244.34 for net turnover and 335.69 for net profit indicate a highly concentrated distribution around a central value, but with the presence of very large outliers. Skewness of 14.76 for net turnover and 16.19 for net profit confirms this strong skewness, with most firms having values much lower than the average, while a small number of firms with very high values pull the average upwards. Personnel expenses and average number of employees also show a significant skewness (skewness of 9.73 and 13.69), indicating that most firms have relatively small structures, but there are also a few firms with very large numbers of employees and associated expenses.

The statistical analysis reveals an industry characterized by strong polarization, with a few large companies dominating the market and numerous small or medium-sized firms. This asymmetric distribution suggests that smaller firms find it difficult to compete with larger players with superior resources and infrastructure. At the same time, the high dispersion across indicators underlines the need for economic policies to support the balanced development of the sector, especially for smaller firms.

Table 2 provides an overview of the average performance of firms in Romania's counties engaged in pharmaceutical wholesaling. Interpretation of the data reveals significant variations across counties, reflecting the unequal distribution of resources and economic capacity.

At national level, the average turnover is 46,766,656 lei, but there are marked differences between counties. Bucharest (52,525,322 lei), Ilfov (85,774,699 lei) and Iași (17,670,257 lei)

dominate with high values, reflecting their role as important economic centers in pharmaceutical distribution. Also, Tulcea (191,179,683 lei) and Argeş (458,591,068 lei) counties record exceptional values, signaling the presence of large players on the market. In contrast, counties such as Sălaj (RON 227,229) and Gorj (RON 376,703) show extremely low turnovers, indicating low activity in this sector. The average net profit at national level is RON 2,157,472, and the distribution follows the trends observed for turnover. Bucharest (RON 2,930,884) and Tulcea (RON 5,071,020) lead, demonstrating the capacity of these counties to generate high profits. On the other hand, very low profits are found in counties such as Sălaj (29,542 lei) and Gorj (152 lei), which may indicate a lack of competitiveness or economic activity in these areas.

Table no. 2 Average performance of firms in Romanian counties

Counties	Net Turnover	Net Profit	Personnel Expenditures	Average Numberer Employees
Alba	1126995.00	146316.50	67525.50	2.00
Arad	3174353.93	441097.29	201436.07	3.93
Argeş	458591068.92	19534252.00	11091480.15	124.92
Bacău	13593855.25	483753.12	732189.44	10.81
Bihor	9112213.07	872908.59	450935.96	6.44
Bistriţa-Năsăud	11305680.80	629524.40	1114818.20	13.20
Botoşani	1247512.25	6385.50	132349.50	3.00
Brăila	6438827.56	157156.78	1056396.11	10.00
Braşov	71713347.82	654407.43	2791366.04	29.79
Buzău	3564010.00	353935.22	211061.44	3.67
Călăraşi	6078347.00	935552.75	649113.25	5.00
Cluj	19581812.75	1423009.18	1063808.43	8.93
Constanţa	5279753.83	584750.57	333709.52	5.43
Covasna	1390005.00	179716.75	188867.50	3.00
Dâmboviţa	5217453.80	771623.80	125454.20	3.60
Dolj	12166310.12	555707.21	516067.38	8.17
Galaţi	46007400.00	1140800.00	909664.00	17.30
Giurgiu	13772037.67	252436.00	729739.33	8.50
Gorj	376703.50	152.50	37428.00	1.00
Harghita	3066241.00	101787.00	458263.00	10.00
Hunedoara	70672121.67	2435076.33	2133436.67	27.44
Ialomiţa	4632331.00	1674325.00	63916.00	2.00
Iaşi	17670257.39	1106393.27	1094649.68	13.12
Ilfov	85774699.14	1894125.72	2015747.20	21.54
Maramureş	21120461.53	1661596.73	1734666.93	14.80
Mehedinţi	17923590.50	189589.50	256919.50	5.50
Bucharest	52525322.76	2930884.47	2921500.29	18.36
Mureş	73751999.61	1740595.39	2400967.47	24.78
Neamţ	3086689.78	337205.67	108152.11	3.44
Olt	3499693.00	286985.00	984978.00	13.50
Prahova	26554898.72	922626.72	835550.56	14.06
Sălaj	227229.50	29542.00	24063.50	1.00
Satu Mare	1090430.50	168201.00	79412.25	2.25
Sibiu	5316034.41	230220.12	479845.29	6.06
Suceava	29043902.67	685166.67	952645.33	17.50
Teleorman	19816140.80	958818.60	1941934.20	23.80
Timiş	12907433.82	1072502.93	638909.07	6.91
Tulcea	191179683.00	5071020.00	4051921.00	53.00
Vâlcea	24213318.00	1371763.50	645785.50	9.00
Vaslui	24951356.80	1577911.20	311757.80	5.40
Vrancea	6390634.83	577948.00	228255.00	4.50
Total	46766656.63	2157472.35	2082896.98	16.81

Source: Author's own processing

The average personnel expenditure is 2,082,896 lei. The counties with the highest expenses include Tulcea (4,051,921 lei), Bucharest (2,921,500 lei) and Maramureş (1,734,667 lei), which may reflect the presence of large firms with complex structures. In contrast, counties such as Sălaj (24,063 lei) and Satu Mare (79,412 lei) have very low expenditures, suggesting small firms or fewer activities in this sector. At national level, the average number of employees per firm is 16.81. The highest values are recorded in Tulcea (53 employees), Argeş (124.92 employees) and Teleorman (23.8 employees), indicating the presence of large firms with large workforces. At the opposite pole, counties such as Gorj (1 employee) and Sălaj (1 employee) show very small firms or limited economic activity.

The data reflect an unequal distribution of pharmaceutical activities in Romania. Developed areas, such as Bucharest-Ilfov and Transylvanian counties (Cluj, Brasov, Mures), show high values for all indicators, while counties in the South-East and South-West (Gorj, Sălaj, Mehedinţi) lag far behind. This suggests that economic and logistic infrastructure plays a key role in supporting the financial performance of pharmaceutical firms.

The analysis shows that pharmaceutical activity is concentrated in a few large counties and urban centers, while many counties have little or almost no activity in this sector. These disparities highlight the need for strategic interventions to support the uniform development of the pharmaceutical sector across the country. In addition, economically high-performing counties can serve as models for implementing successful strategies in less developed regions.

Using a classification of firms by taxpayer category, of the 1,164 firms analyzed, small taxpayers predominate among the 1,164 firms analyzed, making up most companies in the industry. This suggests a segmented market in which most players have limited resources and capacity, probably operating in local or regional markets. Although small firms are numerically dominant, large contributors play a key role in the industry, even if they are much smaller in number. These companies are most likely to make a disproportionately large contribution to the total turnover and profit generated in the sector, with access to extensive resources, well-developed infrastructure and scalable strategies (Gikas, 2024). They are the main pillars of the pharmaceutical industry and center market dynamics around them. On the other hand, medium-sized contributors occupy an intermediate position, acting as a bridge between small and large firms. They have the potential to become a bridge of development for the sector, having more flexibility than large firms, but also more resources than small ones. They can act as an engine for growth if they benefit from favorable conditions.

The strong polarization between large and small firms reflects the challenges of an industry where differences in resources and capabilities significantly influence economic performance. The predominance of small taxpayers' points to a huge potential for growth, but also to a need for support for these firms to become more competitive (Stan, 2021; Stan 2022; Paraschiv & Stan, 2023). At the same time, large taxpayers remain essential to sustain the financial stability of the entire sector.

From this perspective, any strategy to support the pharmaceutical sector should be customized to the particularities of each category of taxpayers, considering the needs and potential of each taxpayer category. Small firms need support to develop their capabilities, medium-sized firms can benefit from policies that enable them to evolve into large firms, and large companies need to be supported in maintaining their position in the global market. This dynamic makes the distribution of contributors a central dimension of any analysis of the financial performance of the pharmaceutical sector in Romania.

The results presented in Table 4 reflect a significant difference in the financial performance and organizational structures of pharmaceutical firms in Romania, depending on the size of the taxpayer. The analyzed indicators highlight the strong polarization between large, medium and small taxpayers.

Large taxpayers record the highest values for all indicators. The average turnover of around RON 521 million is far higher than the other categories and the average net profit of over RON 16 million indicates remarkable economic efficiency. Personnel costs are also considerably higher at almost 19.5 million lei, reflecting complex organizational structures and a large workforce. This conclusion is supported by the average number of employees, which reaches 139.77, significantly higher than in the other categories.

Table no. 3 Average indicators by taxpayer size

Taxpayer category	Net Turnover	Net Profit	Personnel Expenditures	Average Number of Employees
Large	521480043.55	16072501.93	19445787.64	139.77
Small	2869597.48	436217.62	204577.99	3.22
Medium	37906338.83	3645950.74	2856213.81	23.43
Total	46766656.63	2157472.35	2082896.98	16.81

Source: Author's own processing

In contrast, small taxpayers demonstrate modest financial activity. The average turnover of almost 2.87 million lei and the average net profit of 436,217 lei indicate limited resources and a low capacity to generate significant profits. The average personnel costs of 204,577 lei and the average number of employees of 3.22 suggest that these firms operate on a small scale, probably focused on local and regional markets. Medium-sized taxpayers fall between the two extremes, with an average turnover of 37.9 million lei and an average net profit of around 3.65 million lei. These firms have average personnel costs of over 2.85 million lei and have, on average, 23.43 employees. These indicators reflect stable economic activity, with a higher growth potential than small taxpayers, but without reaching the economic performance of large taxpayers.

5. Conclusions

Overall, the national average for all firms in the pharmaceutical sector reveals a net turnover of about 46.7 million lei, a net profit of 2.15 million lei, personnel expenses of 2.08 million lei and an average number of 16.81 employees per firm. These values are significantly influenced by large taxpayers, which dominate the sector in terms of financial performance.

The disparities between the three categories suggest a concentration of resources and economic success among large taxpayers, while most small and medium-sized companies operate at much lower levels. This polarization highlights the importance of supporting small and medium-sized taxpayers to reduce the gaps and stimulate sustainable economic growth in the pharmaceutical sector. At the same time, these differences raise questions about the long-term competitiveness and sustainability of small firms, which could benefit from specific economic policies and strategies to improve their performance.

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Business Innovation for Circular Economy

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Abstract

This research explores the contribution that business innovation brings in driving the circular economy implementation within Europe, focusing on its economic, environmental, and societal impacts. Through a mixed-methods approach, the study examines technological progress, policy frameworks, and evolving consumer behaviors that promote sustainable business practices. Sector-specific case studies demonstrate practical innovations, such as AI-enabled waste sorting, closed-loop systems, and subscription-based models for electronics. Challenges, including financing gaps and fragmented regulations, are balanced by opportunities for technological advancements and collaborative initiatives. Using a comprehensive SWOT analysis, the study highlights pathways to strengthen circular economy strategies, encouraging greater policy coherence and stakeholder engagement. This research underscores Europe's potential to lead in sustainability through integrated efforts, fostering resilience and long-term economic growth.

Key words: circular economy, business innovation, business practices, SWOT analysis

J.E.L. classification: M10, Q01

1. Introduction

As the global economy continues to grapple with the challenges of sustainability and environmental conservation, the circular economy has emerged as a core strategy for reducing waste, conserving resources, and promoting sustainable development (Panait et al., 2022). Worldwide, trends such as enhanced product lifecycle management, growth in recycling and upcycling, and the adoption of circular business models are transforming industries and influencing consumer behavior. In Europe, the circular economy is particularly significant due to the region's strong policy framework and commitment to environmental protection (Apostu et al., 2023).

The European Union (EU) has made significant strides in advancing circular economy research, driven by a strong policy framework and increasing investment in innovation. Recent research highlights the growth of circular economy sectors, such as recycling, repair, and reuse, which are aimed at reducing waste and resource dependence (von Kolpinski & Kratzer, 2025). The EU's circular economy action plan emphasizes the importance of monitoring progress through indicators like material footprint and consumption footprint to ensure alignment with climate neutrality goals (Circular Economy Action Plan - European Commission, 2020). Additionally, a growing body of scientific literature, with nearly 4,000 articles published in 2023 alone, underscores the expanding knowledge base in this area. Such research momentum is supported by funding opportunities from programs like Horizon Europe and the European Investment Bank, which have increased lending to circularity projects (Circular Economy - European Commission, 2024).

Despite these advancements, several challenges persist in the implementation of circular economy principles across EU countries (Castillo-Díaz et al., 2024). One of the primary hurdles is the need for more comprehensive policy implementation and financial support. The transition from linear to

circular systems also requires radical innovation and digitization, which EU programs can facilitate focused on research and innovation (Nicolau et al., 2024). Furthermore, the circular economy faces threats such as supply chain risks and regulatory challenges, which necessitate consistent investments and strategic planning.

This study aims to explore the dynamics of business innovation within the circular economy in Europe, examining how technological advancements, policy initiatives, and changing consumer preferences are driving sustainable business practices and economic growth across the region.

2. Literature review

The circular economy has emerged as a strategy for sustainable development, focusing on reducing waste, conserving resources, and promoting environmental quality. In the European Union, business innovation focuses on contributing to the transition from linear to circular economic models. EU businesses are increasingly adopting circular practices, with a notable rise in the certification of green products and services. For instance, there has been a four-fold increase in European Ecolabel certifications since 2010, indicating a growing commitment to sustainability among European companies. This shift is supported by a robust policy framework and financial instruments like those provided by the European Investment Bank (Bătae et al., 2021), which has co-financed numerous circular economy projects across various sectors.

Research on business innovation in the circular economy highlights significant advancements in Europe. The circular economy sector employs approximately 4.3 million people, reflecting a dynamic workforce and growing economic impact. Studies have shown linear growth in circular economy sectors, with variations across member states, suggesting opportunities for further development (Robaina et al., 2020). The European Commission's Circular Economy Action Plan has spurred initiatives aimed at sustainable waste management and product circularity (Radu et al., 2023), contributing to economic prosperity and environmental protection. Despite these achievements, challenges persist, including the need for enhanced policy implementation and more comprehensive data monitoring to assess the effectiveness of circular economy strategies.

Previous studies have explored various aspects of the circular economy, such as the impact of circular business models on economic growth and resource efficiency (Kirchherr et al., 2018; Ghisellini et al., 2016). Indicators such as circular material use rates, recycling efficiency, and economic contributions from circular activities have been widely discussed in the literature, providing empirical evidence of the positive influence of circular initiatives on sustainability (García-Barragán et al., 2019). However, despite progress, significant challenges persist, including the lack of comprehensive data monitoring, financial barriers, and regulatory inconsistencies across EU member states. These challenges often result in fragmented implementation efforts, limiting circular strategies' scalability and overall impact.

A notable gap identified in the literature is the absence of a comprehensive framework that links research findings with regulatory policies and business innovation strategies. While studies have examined individual aspects - such as consumer behavior, financial investments, and technological innovation - there is a need for an integrated approach that captures the interplay between these elements. To address this gap, this study proposes a SWOT analysis that consolidates insights from academic literature, regulatory policies, and practical business experiences. Such an analysis can provide a structured understanding of the strengths, weaknesses, opportunities, and threats facing the circular economy, offering actionable recommendations for policymakers and business leaders alike.

The transition to a circular economy requires a concerted effort to align research, policy, and business innovation. By addressing existing gaps and leveraging strategic opportunities, the EU can reinforce its position as a leader in circular economy practices, setting a global benchmark for sustainable development and economic resilience.

One of the key contributions of this study is its focus on integrating policy interventions with practical business applications, offering a holistic perspective on circular economy adoption. Unlike previous studies that primarily focus on theoretical frameworks or case-specific analysis, this research bridges the gap by aligning regulatory frameworks with real-world business practices, drawing insights from both primary data and existing literature. Despite the EU's extensive policy initiatives, such as the Green Deal and Horizon Europe, the effectiveness of these programs in

fostering business innovation at the regional and sectoral levels remains an area requiring further exploration.

3. Research methodology

This study employs a mixed-methods research approach to examine business innovation within the circular economy, focusing on the European context. The methodology combines qualitative and quantitative techniques to provide a comprehensive understanding of how technological advancements, policy initiatives, and consumer preferences drive sustainable business practices. The research also integrates a SWOT analysis based on public reports and research literature to explore how strengths, weaknesses, opportunities, and threats shape the progress and challenges of implementing circular economy principles while fostering innovative business models. This approach incorporates insights from the ever-growing body of research literature on circular economy, as well as established frameworks like the European Commission's Circular Economy Action Plan and detailed industry-specific studies. By doing so, it provides a more relatable and dynamic understanding of the factors influencing sustainable business innovation, emphasizing practical applications and real-world challenges.

The analysis was guided by a critical realist positioning, allowing for an in-depth exploration of the complex interactions between businesses, stakeholders, and policy environments in the context of circular economy transitions. Thus, the best practices and barriers to implementation were identified, providing insights for policymakers and business leaders seeking to foster sustainable innovation. This study is part of a broader research initiative employing these methods to synthesize key results comprehensively, ensuring that the findings contribute meaningfully to both academic discourse and practical policymaking.

3.1 Data Collection

Primary Data:

The practical applications of circular economy principles were observed through case study of companies representing diverse sectors—manufacturing, agriculture, retail, technology, and waste management (Stan, 2022, p.167). For example, in the manufacturing sector, several companies in Europe have implemented closed-loop recycling systems, significantly reducing waste and raw material dependency. In agriculture, bio-based fertilizers derived from organic waste are being more frequently used by farmers, demonstrating resource efficiency. In the IoT retail chain, repair and resale services for consumer electronics are being more actively implemented by companies, promoting reuse over disposal. In the technology sector, startups were identified to have developed subscription models for refurbished laptops, ensuring prolonged product lifecycles. Finally, waste management companies look into leveraging AI-driven sorting technology, to achieve unprecedented recycling precision and efficiency. These examples highlight how diverse industries integrate circular principles to address environmental challenges while enhancing economic performance.

Secondary Data:

This research drew extensively from existing literature, reports, and databases, such as the European Commission's Circular Economy Monitoring Framework and the European Investment Bank's circular economy project reports. Statistical data on key indicators, including circularity rate, material footprint, and sectoral employment figures, were obtained from Eurostat and corroborating publications.

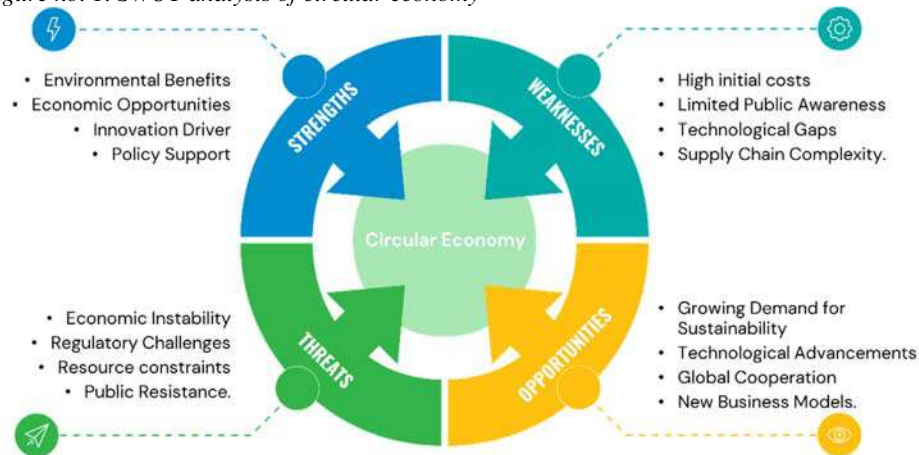
3.2 Data Analysis

Qualitative data were analyzed using thematic coding to identify recurring patterns and insights, forming a basis for interpreting the drivers and barriers in circular economic practices. Quantitative data analysis, including statistical evaluations of economic indicators, employment trends, and circularity metrics, provided a robust understanding of measurable impacts. Comparative analyses highlighted disparities and growth patterns across EU member states, adding a regional dimension to the findings.

4. Findings

The implementation of circular economic practices in business is a complex process that involves understanding the strengths, weaknesses, opportunities, and threats (SWOT) associated with this transition. Our analysis highlights several key findings, integrating relevant literature, policy interventions and business trends into an informative framework.

Figure no. 1. SWOT analysis of circular economy



Source: Own representation

The study's findings and data analysis were effectively synthesized into a SWOT analysis of the circular economy. This approach combined insights from existing literature with policy measures and real-world business cases, resulting in an insightful evaluation of strengths, weaknesses, opportunities, and threats.

4.1. Strengths of circular economic initiatives

A key advantage of implementing circular economic practices lies in their capacity to drive innovation and technological progress while delivering both economic and environmental benefits. Transitioning to circular models encourages the creation of advanced technologies and production methods that optimize resource use, promote recycling, and support material reuse. Perotti et al. (2024) highlight the significance of open innovation within collaborative networks as a catalyst for embedding circular economic principles. Adopting these practices enables businesses to lower expenses related to raw material extraction and processing, improve resource efficiency, and generate employment opportunities in industries such as recycling and remanufacturing.

The European Union's circular economy strategy underscores the importance of preserving the value of materials while reducing ecological impact, aligning with sustainable business development goals (Yousaf et al., 2022). Notably, industries like fashion have excelled in adopting circular practices, showcasing initiatives like clothing reuse and recycling programs that strengthen consumer engagement and support sustainability (Herciu et al., 2023).

Circular business initiatives have yielded substantial economic and environmental dividends, corroborating findings from various studies. In 2024, activities related to the circular economy contributed an estimated €147 billion to the EU GDP, aligning with research by Nicolau et al. (2024), which highlights the economic benefits of increased resource efficiency. Employment in circular economy sectors reached 4.6 million jobs, mirroring trends reported by Grybaitė and Burinskienė (2024), who emphasize the job creation potential in recycling, repair, and reuse industries. Environmentally, a 15% reduction in material footprint per capita between 2020 and 2025 underscores efficiency gains, consistent with Borrello et al. (2020), who documented similar improvements in resource productivity across circular initiatives. These outcomes illustrate how strategic investments and innovations in the circular economy generate measurable benefits across economic and environmental dimensions.

4.2 Weaknesses and challenges for circular economy implementation

While the circular economy offers substantial benefits, its widespread adoption faces notable challenges. Key obstacles include insufficient funding, a lack of economic incentives, technological limitations, knowledge gaps, and the high costs of recovering certain materials (Aivaz, 2021). Furthermore, difficulties in securing stakeholder support for new solutions and fragmented regulatory frameworks exacerbate these issues. These challenges align with broader findings in the literature regarding barriers to implementing circular practices in business operations.

The European Union has introduced initiatives to tackle these hurdles, such as the InvestEU program and European Structural and Investment Funds, which aim to drive innovation in circular solutions. For instance, the Circular Economy Business Innovation Centre (CEBIC) in Victoria exemplifies how targeted grants can effectively support businesses transitioning to circular models.

Consumer preferences increasingly favor sustainable products, as supported by an expanding body of research (Teodorescu et al., 2023). For example, Ghisellini et al. (2016) emphasized the growing societal interest in sustainability as a catalyst for circular economy adoption, suggesting that consumers are becoming more mindful of the ecological impact of their purchasing decisions. Kirchherr et al. (2018) further emphasized this trend, indicating that the rise in consumer demand for green products is a driving factor in the corporate adoption of circular models. Surveys show that approximately 67% of EU consumers prioritize goods with minimal environmental impact, a finding consistent with Whalen (2019), who reported a notable increase in consumer preference for circular and resource-efficient solutions globally. The expansion of product-as-a-service models, particularly in electronics leasing, reflects these changing preferences and illustrates how businesses are adapting to align with evolving consumer values. The shifts in consumer behavior are reshaping markets and promoting the integration of sustainable practices across industries.

4.3 Opportunities and technological advancements in business

The circular economy presents businesses with significant opportunities to innovate and reshape their operations. Initiatives aimed at establishing networks where businesses can collaborate, share resources, and experiment with waste-reducing models are becoming increasingly prominent. The European Union's circular economy strategy highlights the essential role of research and innovation in achieving large-scale transformations, aligning with broader objectives such as the Green Deal, which seeks to overhaul material use and management practices.

The EU's Horizon Europe program supports large-scale systemic solutions and regional demonstration projects, such as the circular cities initiative, which can help businesses leverage digital technologies to enhance circularity (Aivaz & Tofan, 2022). Rising consumer demand for sustainable products further propels businesses toward adopting circular approaches. For example, furniture manufacturers are responding by launching eco-friendly product lines and recycling programs, minimizing environmental impact and strengthening brand reputation and customer loyalty.

Technological innovation is a cornerstone of the EU's circular economy progress. Advanced recycling technologies, such as chemical recycling, have significantly improved material recovery rates, particularly for plastics. Digital platforms, such as those championed by the Circular Economy Business Innovation Centre (CEBIC), have catalyzed collaboration among SMEs, fostering resource efficiency and the sharing of materials. Furthermore, the integration of IoT and AI into smart manufacturing processes has facilitated predictive maintenance and optimized resource utilization, underscoring the transformative potential of technology in circular models.

4.4 Policy Initiatives to mitigate CE threats

Threats to the circular economy in the EU include environmental degradation, economic instability, and social inequity. The continued reliance on linear economic models contributes to significant environmental impacts, including greenhouse gas emissions and waste accumulation. Economic instability can hinder investment in circular technologies and practices, while social inequity may arise from unequal access to circular economy benefits. To mitigate these threats, the

EU is expected to continue to strengthen its policy framework, enhance financial support, and foster innovation. This includes promoting sustainable business practices, implementing effective waste management strategies, and ensuring that circular economy principles are integrated into national recovery and resilience plans (Grybaitė & Burinskienė, 2024). By addressing these challenges and threats, the EU can accelerate its transition to a circular economy, achieving sustainable development and environmental protection while maintaining economic prosperity (Brasoveanu, 2023a; 2023b).

The circular economy also faces several *threats* that can impede its progress. Stakeholder acceptance of new circular solutions can be challenging, as it often requires changes in consumer behavior and business operations. Additionally, competition from traditional linear models can pose a threat, especially in industries where circular practices may initially increase costs or reduce profit margins. Stakeholder acceptance of new circular solutions can be challenging, requiring significant communication and engagement efforts (Paraschiv & Stan, 2023). The lack of legislative solutions and low public awareness can hinder the adoption of circular economic practices. Furthermore, the long-term nature of investments required for circular economic transitions can deter companies, especially in competitive markets where short-term gains are often prioritized.

The EU strives to address these challenges through policy interventions such as the Circular Economy Action Plan, which aims to streamline regulations and support the transition to circularity (Borrello et al., 2020). For instance, the EU's Circular Economy Strategy emphasizes the need for novel governance models and collaborative approaches to overcome regulatory hurdles.

The EU's policy frameworks have played significant roles in advancing circular business practices. The Circular Economy Action Plan (CEAP) has incentivized the adoption of circular models, evidenced by an increase in material circularity rates from 11.8% in 2023 to 13.2% in 2025. Financial mechanisms, such as Horizon Europe's allocation of €2 billion for circular economy projects, have mitigated the high initial costs associated with these transitions. Additionally, the establishment of uniform standards, such as the European Ecolabel, has streamlined market entry for sustainable products, promoting wider industry compliance.

4.5 Limitations for study and future research opportunities

The limitations of the current research present opportunities for future research development. Firstly, the focus on EU policy interventions and European businesses may limit the generalizability of findings to other regions. Future studies could explore how different regulatory frameworks and ethnic and cultural contexts influence the adoption of circular economy practices globally (Aivaz & Petre, 2024; Petre & Aivaz, 2024). Secondly, the study primarily examines large-scale businesses; future research could delve into the challenges and opportunities faced by small and medium-sized enterprises (SMEs) in transitioning to circular models. Additionally, the economic analysis is based on existing data; future studies could benefit from longitudinal data collection to assess the long-term financial impacts of circular economic strategies.

5. Conclusions

Business innovation in the circular economy is driving transformative change within the EU, serving as a critical lever for achieving sustainability goals. The convergence of technological advancements, such as AI-driven waste management and IoT-enabled resource optimization, alongside robust policy frameworks like the Circular Economy Action Plan (CEAP), has fostered an environment conducive to innovation. Moreover, evolving consumer behaviors, marked by a preference for sustainable and resource-efficient products, have amplified demand for circular practices. These combined forces stimulate economic growth, as evidenced by significant contributions to GDP and job creation and also facilitate environmental preservation through reduced material footprints and waste.

Technological progress, particularly in areas like AI and IoT, is essential for enhancing circularity in manufacturing and waste management. Policy instruments such as the CEAP and financial programs, including Horizon Europe, provide the necessary support to surmount barriers to circular adoption. Additionally, growing consumer awareness of sustainability bolsters the business case for circular innovation.

To build upon these successes, this study advocates enhanced monitoring and data collection frameworks to ensure the effective implementation of circular policies. Increasing public awareness through targeted educational campaigns (Dumitru et al., 2014) will further engage consumers with circular economy practices. Strengthening collaborations between the public and private sectors is essential for scaling innovations and creating synergies. Finally, sustained investments in research and development are crucial for developing scalable, cost-effective recycling and manufacturing technologies. By addressing these areas, the EU can consolidate its leadership in the circular economy, setting a global benchmark for sustainable development and economic resilience.

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Cross-Mapping Interactions between Corruption, Accounting and Audit: A Bibliometric Analysis

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Abstract

Recent literature considers corruption as a plague of society which exceeds beyond political areas, that initially consecrated it about three decades ago and ends up affecting the economic sphere and at the same time negatively impact the lives of individuals and economic activities. The aim of this study is to develop a bibliometric analysis and a scientific mapping of existing research regarding the relationship between corruption, accounting and audit, using the Vosviewer application and the Web of Science Core Collection database, from 1995 to 2024. Based on literature review of a sample of 211 studies, the findings reveal that corruption negatively affects the quality of accounting and auditing through accounting fraud, financial reporting manipulation, bribery, incentives, unofficial payments or hidden audit fees, conflict of interest, avoidance of transparency and disclosures rules. This analysis highlights the importance of public policies in anti-corruption fight and accounting rules' development, undesirable with corruption.

Key words: accounting, audit, corruption, bibliometric analysis, Vosviewer

J.E.L. classification: M41, M42, D73

1. Introduction

Unfortunately, corruption has become ubiquitous in the contemporary world, arousing the interest of governments, various international institutions and the academic community, as it affects all spheres of economic, social and political life. Describing the mechanisms whereby corruption manifests itself, identifying the indicators by which it could be measured and, above all, implementing those policies through which it can be combated, represent major challenges of today's economies. Corruption affects both the public and private spheres, and many of its forms are still unknown, insufficiently explored and difficult to discover, because corruption involves hidden links between individuals, who use their power and functions to obtain undeserved personal benefits.

Although blamed in all institutional and governmental approaches, corruption still dominates diverse environments, societies and economies. Previous research suggests that the negative impact of corruption on economic growth and development is a challenge faced by all contemporary societies, affected by various forms of corruption, on a financial or non-financial level, on a large or small scale, in public or private environments (Bahoo et al., 2021, p. 565). On the other hand, a new wave of studies is emerging that bring arguments in favour of the benefits of corruption for the states, framed in the "grease in the wheel" stream, according to which the mechanisms of corruption (different corrupt practices, nepotism, bribery, etc.) act as a lubricant that speeds up bureaucratic public procedures and reduces the time (Boudjana et al., 2023, p. 101). The opposite of this approach - represented by the "sand in the wheel" - has associated corruption with the decrease in the ability of companies to do business, obstacles to economic growth, the decrease in human capital, the proliferation of the shadow economy etc. (Hoinaru et al., 2020, p. 3).

Accounting or auditing does not escape corruption either and the internal mechanisms through which corruption takes hold of these professional fields have been refined over time and are often almost impossible to unmask (Matei and Aivaz, 2023, p. 986; Savu et al., 2022, p. 1021; Malagueño et al., 2010, p. 372). The accounting choices of entities in regions with corruption are especially oriented towards the manipulation of revenues and earnings (for the reduction of taxes and fees owed to the state and various authorities), the recognition of losses in a faster manner, different accounting methods of accelerated depreciation in the conditions in which corrupt and abusive officials pursue personal financial interests from bribery and accept illegal accounting and tax practices (Zhang and Zhang, 2023, p. 443). The impact of strong accounting standards on corruption turns out to be non-linear, and auditing moderates the relationship between them, while financial disclosure and perceived strength of accounting and auditing standards significantly reduce perceived corruption (Rahman, 2024, p. 414).

Starting from these fundamentals of the possible positive or negative effects of corruption on economic activity, but also with the intention of delimiting the causal and/or bidirectional relationships between corruption and accounting, respectively audit, the study aims to answer the following research questions:

RQ1. What is the tendency of publications on corruption, accounting and audit??

RQ2. What topics involving interactions between corruption and accounting, respectively auditing, are addressed by specialized literature?

The central objective of the study is to analyse the prevailing body of literature on corruption, accounting and audit, to determine which are the favourite topics addressed in the studies on the mentioned topics, how the approaches are clustered and what are the trends that can be identified in a literature on the subject that is not very vast and of relatively recent date.

This paper contributes to literature on corruption and accounting, respectively audit, in several ways. First, it focuses on the connection between these major topics and describes the existing studies on the field, through bibliometric analysis and literature mapping. Second, this study identifies and describes the main research directions that have analysed the subject in the existing literature and that have led to prior mixed findings. This approach contributes to the understanding of the influences and mechanisms by which corruption influences accounting or auditing, and how these fields, in turn, affect corruption.

The rest of the paper is structured on the following sections: after presenting the current stage of knowledge in the field and the theoretical background, it continues with the presentation of the research methodology, results and discussions and ends with conclusions and bibliographic references.

2. Theoretical background

Based on a recent previous literature, where studies on the interactions between corruption, accounting and/or auditing are limited, this section presents the key themes identified in prior research. It aims to outline the general characteristics of corruption and its economic impact, particularly on accounting and auditing practices. Additionally, the literature examining how accounting and auditing can either foster corruption or, conversely, assist in its control and eradication is also explored.

In general, corruption is associated with the public sector, as "the misuse of public office for private gain" (Wawrosz, 2022, p.1), but once with the change of perspective and the embracing of the idea that corruption affects all sectors and areas of life, the definition has been nuanced and many studies use the definition agreed by the Transparency International, a non-governmental organization fighting against corruption, that defined the term as being "the abuse of entrusted power for private gain" (Transparency International, 2024). Corruption is usually the consequence of many factors including individual traits, social norms and situations, the behaviour of other people, and so on (Wawrosz, 2022, p. 3), and as such, due to its wide meaning of the term of corruption, there are various definitions of it (Mantescu, 2022, p. 646).

A person can act in accordance with the law and condemn corruption in some situations, but still act in a corrupt manner in another situation. Also, it is important to understand that even if in the past corruption was mostly associated with the purpose of gaining personal benefits, there are authors

who stated that there might be many other reasons for a persons' corrupt way of acting, beyond private gains (Hodgson and Jiang, 2007 in Wawrosz, 2022, p. 4). These authors also concluded that the lack of research on corruption reasons leads to limited contributions of the theoretical studies to practice.

The phenomenon of corruption is a complex one, whose roots are difficult to identify entirely, but the following four theories could summarize the different facets of corruption in public sector (United Nations Office on Drugs and Crime, 2021):

- *The principal-agent theory* (where the agents are the public officials, whose role should be to protect the interests of the principal, represented by citizens, the public, companies etc. Often, however, public officials have personal interests that generate corruption);
- *The collective action theory* (which explains corruption as a generalized, systemic phenomenon, a true social norm, given that individuals believe that if those around them have corrupt behaviours, then this is normality);
- *The institutional theory* (which present corruption as a result of the institutional characteristics of countries and governments, which deviate from their role and contribute to the institutionalisation of corruption);
- *The game theory* (which describes corruption through the corrupt behaviour of public officials, who choose to engage in corrupt practices, as those around them do so, even if in general, corrupt actions do not bring them greater benefits than in the absence of corruption. They face the "prisoner's dilemma", the fear of being disadvantaged if they do not resort to corrupt practices and experience a conflict between their intrinsic way of reasoning and the mentality of the corrupt group).

The phenomenon of corruption is on the agenda of numerous international institutions, which develop policy frameworks on governance and corruption issues, given that corruption is considered a contemporary scourge that is difficult to manage and eradicate. Named in the '90s even "cancer" by the president of the World Bank (World Bank, 2024), corruption is considered by the United Nations as a threat to the stability of societies, which can undermine democratic, ethical institutions and values, justice and compromise sustainable development and the rule of law. Against this background, the United Nations developed in 2003 the UN Convention Against Corruption, which it considers "an insidious plague that has a wide range of corrosive effects on societies" (United Nations, 2003).

Whilst the United Nations defines corruption as "a threat to the stability of societies" (United Nations, 2003), the International Monetary Fund explains this term as a governance vulnerability, that is judged to be macroeconomically critical (International Monetary Fund, 2018).

The intrinsic relationship between corruption and the well-being of individuals is a topic on the World Bank's agenda, one of the institutions involved in the fight against corruption and according to it, two major targets are set for the next years: one being ending extreme poverty by 2030 and the other being boosting shared prosperity for the poorest 40 percent of people in developing countries (World Bank, 2023). Even if eradicating corruption may not be possible, lowering its level has a direct impact on the purpose of a society where all countries are prosperous, but this goal cannot be achieved without eradicating extreme poverty in the developing countries, where 40 percent of people live in poverty.

This concern was also expressed by the United Nations in 2023 when it was analysed the level of achievement of the Sustainable Development Goals. It was stated that with just seven years left to achieve the global goals, the progress towards achieving Goal 16, which calls for peace, justice and strong institutions, is dangerously off track because, among other reasons, widespread corruption persists, especially in low and middle-income countries, impacting individuals and businesses (United Nations, 2023). One of the Sustainable Development Goals is *Global unity needed to recognize threat of corruption (SDG 16)*, whose analysis from 2023 showed that widespread corruption persists, especially in low and middle-income countries, impacting individuals and businesses (United Nations, 2023).

Corruption produces effects on three key stages of a good global governance, specifically peace, global security and sustainable development. Corruption causes a domino effect for pieces consisting of foreign direct investments, which are discouraged by a national market where competition is not fair and transparent, economic growth, which becomes stifled, with a final effect on sustainable

development, that is either achieved at a slower pace or is no longer achieved at all (United Nations, 2023). The effects of corruption are not limited to aspects mentioned above, but they also consist in weakening national institutions, influencing gender equality and reducing the trust in public health system (United Nations, 2023).

Corruption is considered harmful to society in the European Union and often associated with the obscure mechanisms of organized crime, terrorism, and other forms of criminality, comprising money-laundering or drug trafficking (European Commission, 2024a). The manifestation of corruption contributes to inequalities, erodes citizens' trust in public institutions, undermines good governance and social justice, and constitutes a serious threat to the rule of law, democracy, and fundamental rights (European Commission, 2024a). Corruption also has a negative impact on prosperity and economic growth by creating business uncertainty, lowering investment levels, hampering fair competition and reducing public finances (European Commission, 2024a). It also adversely affects government objectives that focus on improving income disparity and environmental protection (European Commission, 2024a).

Corruption affects the GDP of European Union by 6% (European Commission, 2024a) and according to a 2023 Eurobarometer survey, 70% of Europeans think that corruption is widespread in their countries, which is 2% higher than in 2022 (European Commission, 2023a). Also, 35% of European businesses consider corruption to be a problem in doing business, while 59% of them agree with the statement that bribery and the use of connections is often the easiest way to obtain certain public services (European Commission, 2023b).

To achieve the goal of combating corruption, the European Commission adopted in May 2023 an anti-corruption package of measures intended to ensure high standards against the full range of corruption crimes. Among others, this package aims to contribute to corruption prevention and create a culture of harmony, but also to update and harmonise EU rules on definitions and penalties for corruption offences (European Commission, 2024b).

Thus, based on the above considerations, we note various facets of corruption in different public and private environments, a generous general previous literature on corruption, as well as the active involvement of numerous international institutions in the development of anti-corruption guidelines and policies.

As regards corruption and its interactions with accounting and/or auditing, previous studies are less widespread and contain specific technical aspects through which the accounting profession can contribute to corruption or can diminish it. When accounting and auditing standards rise, and especially as audits become more mandatory, more frequent, and more independent, countries should experience less corruption (Malagueño et al., 2010, p. 374).

Adoption of international accounting standards positive influence on corruption perception and an indicator named the strength of auditing and reporting standards mediates the relationship, as revealed by a study conducted for 130 countries and three years (Kurniawati and Achjari, 2022, p. 737). Accounting disclosure decreases corruption and there is a direct link between the power of accounting and auditing and corruption – in countries where accounting disclosure is increasing, there is an improvement in the control of corruption, as demonstrated for a sample of 71 states in the period 2010-2017 (Rahman, 2024). Accounting standards that improve the information environment and transparency contribute to the detection of corrupt practices (Taylor et al., 2024; Houqe and Monem, 2016).

On the other hand, national corruption negatively impacts on the speed and extend of IFRS – International Financial Reporting Standards – as the basis of worldwide accounting, as it results from a study developed for 89 non-EU states in the period 2003-2014 (El-Helaly et al., 2020, p. 2). Corruption also negatively influences the quality of accounting in jurisdictions that have already adopted IFRS (Agyei-Mensah, 2017, p. 727).

3. Research methodology

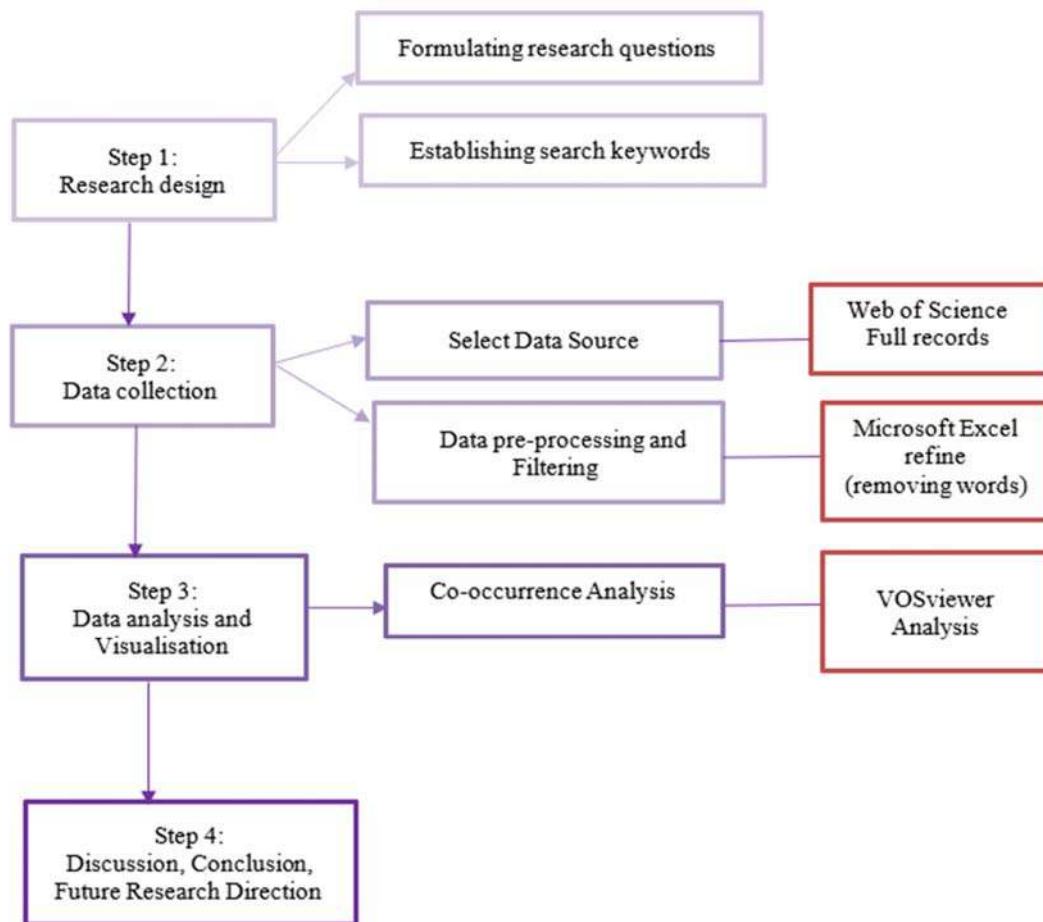
This section outlines the methodology used to conduct the bibliometric analysis and map the existing research regarding the unidirectional or bidirectional relationship between corruption, accounting and audit. Data for this study are obtained from the Web of Science Core Collection

database on 23 October 2024 and the VOSviewer software is used for bibliometric analysis and scientific mapping.

To target relevant studies, we used specific search terms in all fields, all languages, all types of documents and all categories: "accounting", "audit" and "corruption" (using the Boolean indicator "and", in order to identify studies that contain all the three terms). A total of 212 published studies were obtained from this search (of which one was excluded because is a correction of another study). Thus, the sample is composed of 211 studies (published in 1995 and from 2007 to 2024), with an increased interest in the correlation between the three terms starting from 2015. Between 1995 and 2007 there were not published studies with these search terms.

The procedural phases of the research are presented in Figure 1, which highlights a combination between the qualitative analysis and a bibliometric approach, which are based on the studies published in the Web of Science Core Collection database, given the qualitative characteristics of the studies published in it and the prevalence of its use in bibliometric analyses (Bota-Avram, 2024, p. 183).

Figure no. 1. Methodological stages of the research



Source: Authors' own processing

Bibliometric analysis is relatively new in business research, an effective method of summarizing and synthesizing literature, that gained popularity with open access to programs like Vosviewer and which allow handling large volumes of scientific data (Donthu et al., 2021, p. 286).

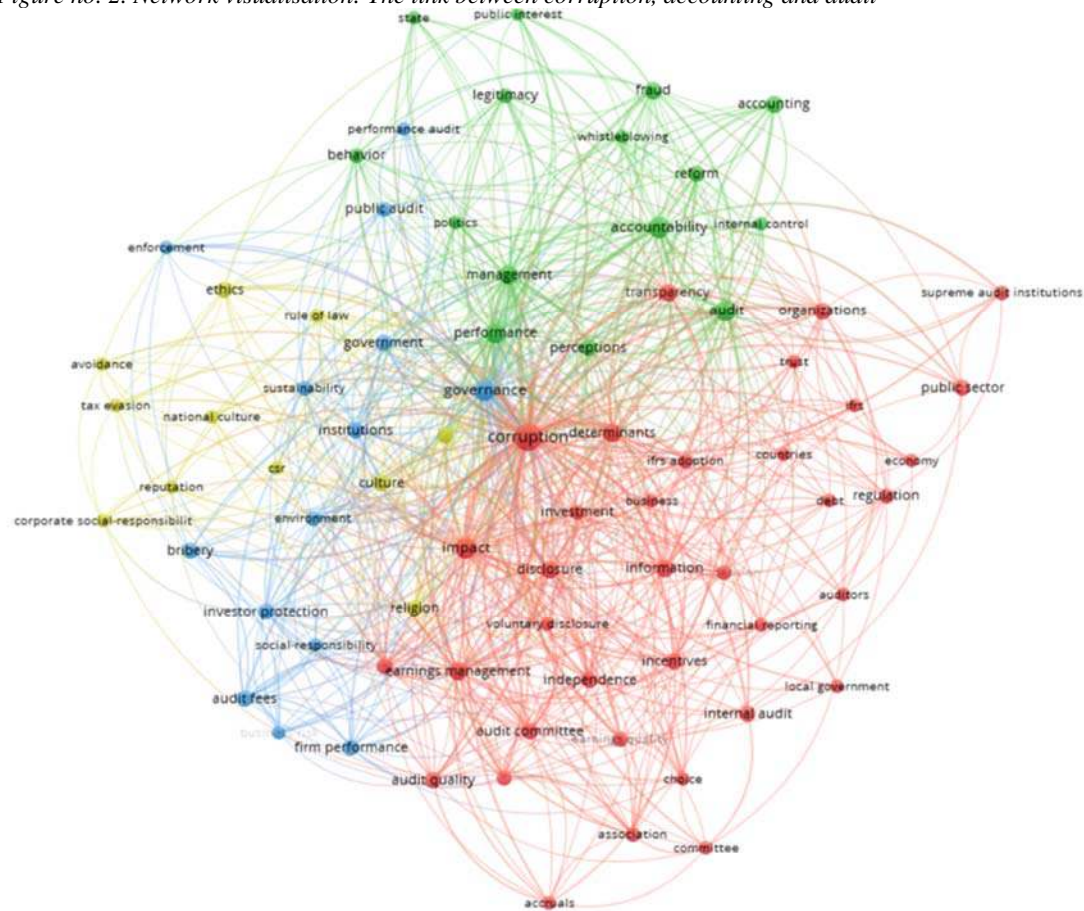
We used VOSviewer program to analyse the co-occurrence of these three key terms previously mentioned, with the aim of identifying the connection between them, present in the studies sample obtained from Web of Science database. By using the full count method, all keywords with at least

four occurrences in the entire study were extracted. The words that had the similar meaning (such as "audit committee" and "audit committees", "reform" and "reforms") were replaced with the same term to avoid duplication of relevant key terms and a possible distortion of the relevance of the links. After replacing these terms, 91 of the 1133 terms met the minimum threshold of 4 occurrences for mapping in VOSviewer. From the list of the 91 terms generated, some terms considered by the authors of the study as not being relevant for the topic under study, were removed, more specifically "Africa", "China", "construction", "corporate governance", "cost", "costs", "firm", "firms", "framework", "market", "media", "networks", "Nigeria", "quality" and "sector".

4. Results and discussions

To achieve the objective, this study employed scientific publications from the Web of Science Core Collection database, on which it applied the search criteria mentioned in the previous section. We graphically configured the map on the interactions between corruption, accounting and audit and Figure 2 exhibits the network visualization of them relationship. The size of the nodes and interconnecting lines that connect them indicates the relevance and strength of the links (Donthu et al., 2021, p. 292).

Figure no. 2. Network visualisation: The link between corruption, accounting and audit



Source: VOSviewer authors' own processing using data extracted from the Web of Science database

The link map was created at a resolution of 0.7, resulting a number of four clusters (Figure 2), in which the most frequent words were *corruption* (119 occurrences and 75 links), *accountability* (32 occurrences and 36 links), *impact* (32 occurrences and 57 links), *performance* (23 occurrences and 45 links), *audit* (29 occurrences and 40 links), *governance* (29 de occurrences and 52 links).

As shown in Figure 2, the analysis revealed the existence of four clusters consisting of groupings of key terms, each of them having a distinct colour. The exploration of this linking network led to the identification of five main research directions.

The first cluster – marked in red – is centred on one of the terms around which is focused the attention of this study, namely corruption, which is associated with audit and financial reporting (audit quality, financial reporting, management, transparency, whether it refers to its existence or whether to voluntary transparency, internal audit). This cluster based on determinants of corruption (between public and internal perspectives of a company) denote that there is a mix of macroeconomic or microeconomic aspects that contribute to the existence of corruption's roots. The analysis of this cluster indicates that financial reporting and the international financial reporting standards IFRS (regardless of whether we refer to aspects regarding the process of IFRS adoption or their actual application), have a direct impact on a state's level of corruption. To the same extent, the public sector's policies and activity, for example the supreme audit institutions' activity, produces effects on a state's level of corruption through the disclosure level of the information it generates. Also, the public sector's policies have a direct impact on the voluntary disclosure level and the earnings management. The choices of the committees related to the internal audit procedures have an impact on the earnings quality, not only on the earnings quantity. Therefore, when the state encourages a fair board composition that allows auditors to carry out their activity in conditions of independence, not only will raise the audit quality, but also the financial reporting quality, with the natural consequence of a decrease in the level of corruption.

The second cluster – marked in yellow – mainly studies explanatory behavioural determinants of corruption (aspects related to religion, culture, national culture, the rule of law, ethics, tax evasion, sustainability). This group links cultural, ethical and non-ethical factors, the rule of law and illegal misconducts in corruption equations. It indicates that the rule of law is powerfully influenced by ethics, national culture, religion, culture. Also, the corporate social responsibility policies and the social responsibility disclosure policies have an impact on tax evasion, positive or negative depending on their content, manner of their enforcement, but also depending on factors that are specific to each country or area, such as ethics, national culture, religion, culture. In conclusion, ethics, national culture, religion and culture can be considered factors that influence the rule of law strength and influence corruption.

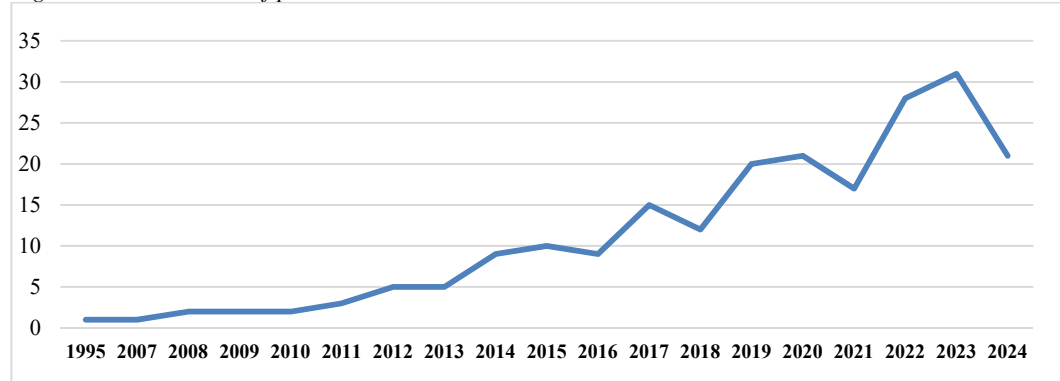
The third cluster – marked in green – revolves around the deep aspects of accounting and auditing, with an impact on corruption (the terms of accountability, audit, accounting, performance, management, fraud, public interest, reform, whistleblowing). This cluster emphasizes the importance of corruption perception in accounting and audit fields. The perception of fraud affects company performance through the internal policies implemented by management boards concerning accounting. The management holds accountability for the policies regarding the accounting activity, which is both responsible not only for the company's performance, but also for ensuring compliance with fraud prevention regulations. From a macroeconomic perspective, implementing a reform that balances public and private interests requires an audit process serves an effective whistleblowing mechanism in managing corruption.

The fourth cluster – marked in blue – highlights the importance of state governance in controlling corruption (has governance as its central element, but also terms such as bribery, performance audit, public audit, sustainability, investor protection, enforcement, audit fees, social-responsibility). This cluster underlines the importance of governance and enforcement in fighting against corruption and presents bribery as a very widespread form of corruption. Social-responsibility and sustainability policies are essential in controlling bribery, given that audit fees can prove in certain circumstances to be tools through which acts of corruption are carried out. In such situations, investor protection and companies' performance are affected, and the role of auditing cannot be objectively manifested, but on the contrary, auditing is integrated into the vicious circle of bribery and thus catalyses corruption.

The network of keywords identified in the published studies shows that interest in studying this topic has increased since 2007 (Figure 3), in the context of the international financial crisis, which carried under the magnifying glass of the international community accounting and auditing behaviors often associated with corruption, in companies that went bankrupt during that period and which, paradoxically, benefited from "clean" audit reports. The set of International Auditing Standards and

the accounting framework represented by the International Financial Reporting Standards (issued by the International Federation of Accountants) have undergone numerous changes in the years after the international financial crisis, in the sense of increasing the degree of confidence of users in the audited financial statements of companies.

Figure no. 3. Evolution of publication's number between 1995 and 2024



Source: Authors' own processing using data extracted from the Web of Science database

This study does not perform an exhaustive content analysis on the 211 papers in the sample, given that it is not methodologically based on the systematic literature review method, which represents a limitation of the research. However, founded on an unstructured examination of the sample, we conclude that previous studies addressing the link between corruption, accounting and audit are mainly based on qualitative research methods, for example the development and exploration of theories underlying corruption, as well as delineations on the positive or negative effects of corruption on the society and economy in general, respectively on accounting and audit in a special manner. Studies applying quantitative research methods, represented by case studies or analysis of applied questionnaires, are less numerous and such specific literature has developed in the recent period, in which methods of econometric analysis of different data series on the interactions between corruption, accounting and audit are used.

5. Conclusions

The aim of this study was to identify the main themes of the interaction between corruption, accounting and audit in the prior published studies. A first stage of research was represented by the analysis of the theoretical framework of the theme, the identification of the general characteristics of corruption, of the international institutions interested in it and the establishment of the favourite themes that concretely examine the links between corruption, accounting and audit. Then, we developed a bibliometric analysis and a scientific mapping of the previous literature, based on sample of published papers in the Web of Science Core Collection, between 1995 and 2024. A total of 211 studies were analysed using the VOSviewer software and a map of the co-occurrence of terms addressing the interactions between corruption, accounting and audit was made. In 1995 only one study was identified, in the period 1995-2007 there are no studies published on this subject, which began to be analysed more intensively after the manifestation of the international financial crisis in 2007, amid growing fears about the role of accounting and auditing in maintaining financial stability. After 2017, the studies are more frequent, which denotes the topicality of the research topic and the growing interest of the scientific community.

The existence of four distinct clusters has been documented, that reproduce the groupings of terms specific to the link between corruption, accounting and audit in the published studies. First cluster focuses on the determinants of corruption, a mix of macroeconomic or microeconomic aspects that contribute to the existence of corruption's roots. Second cluster links cultural, ethical and non-ethical factors, the rule of law and illegal misconducts in corruption equations. The third group of terms refers to the deep technical aspects of the accounting and auditing, with an impact on corruption,

while the last cluster underlines the importance of state governance in controlling corruption, as well as the role of accounting and auditing tools in mitigating corruption.

Previous literature analysing the relationship between corruption, accounting and audit uses both qualitative and quantitative research methods. Existing studies render both the explanatory theories of corruption, its implications on the economy and society in general, but also on accounting and auditing in a distinct manner. Also, we note an incipient flow of literature, in an accessible expansion, which is based on quantitative research methods and econometric analysis of different data series on the links between corruption, accounting and audit.

In terms of public policy, the study is useful by highlighting the complexity of the unilateral and bilateral relationships that can be identified in the literature between corruption, accounting and audit. In this way, the regulatory authorities can have access to useful information in the processes of legislating anti-corruption packages, but also of effective accounting and auditing rules in the control of corruption.

One of the most important limits of this study refers to the analysis of a relatively small number of existing studies in the literature, through a bibliometric analysis and outside the application of the systematic literature review method, which could lead to more reliable results and more valuable findings. Also, the search terms used and the use only of the Web of Science database represent limits of the research. Future research directions aim to explore the issue of the interaction between corruption, accounting and audit in the existing literature based on systematic literature review and by expanding the research on other databases of published studies.

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