

**OVIDIUS UNIVERSITY
ANNALS
ECONOMIC SCIENCES
SERIES**

**Volume XXV
Issue 1**

Year 2025

ISSN-L 2393-3119
ISSN 2393-3127

OVIDIUS UNIVERSITY ANNALS

ECONOMIC SCIENCES SERIES

Volume XXV

Issue 1

2025

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Section I
International Affairs
&
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Regional Development,
Integration and Globalization

SMEs' Multinationalization by Oil and Gas MNCs within the Business Internationalization Process for De-carbonization, Sustainability, Mutual Cooperation in the Carbon Market and Business Values: An Analytical Approach with a Model

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Abstract

This paper analyzes and presents the possibility of Small and Medium Sized Enterprises (SMEs) Multinationalization by Oil and Gas Multinational Companies (MNCs) for a mutual survival and cooperation within and for the business internationalization process. The research methodology relied on a relevant literature review and analytical approach with a designed model for both types of companies that help them cooperate in the carbon market. The findings shows that SMEs need the help and survival of MNCs to raise and leave the local market tights by entering the internationalization process. Oil and Gas MNCs may merge SMEs in their business internationalization process in their foreign locations by multinationalizing them especially if they are innovative SMEs. In conclusion, the mutual cooperation between them may help them work on the process of internationalization, de-carbonization, sustainable business and business values.

Key words: business internationalization, globalization, slowbalization, sustainability, fossil fuels, carbon market

J.E.L. classification: F20, F23, F60, F63, F66, P28, Q20, Q35, Q56, Q58

1. Introduction

The transition to sustainable actions is not only a reaction and reply to the regulatory economic social political technological cultural pressures but it is an opportunity for the Oil and Gas industry to reinvent itself and use the pillar or net-zero and CO₂ emissions' capture and storage for the Oil and Gas production since they are important sources for many other things in other products and industry, starting from the fact that they are main commodities in the global economy. A company can overcome a recession by increasing productivity and reducing non-revenue-generating expenses without cutting staff at all costs. However, making the right decision requires a thorough review and evaluation of the entire structure (Benabed and Bulgaru, 2023).

Oil and Gas have been always main energy resources globally but the face various threats and risks, Oil and gas multinational companies that deal with their operations and business are moving towards another energy transition energy. Oil and gas may survive as important energy resources for the future generation since technological advances that capture and store the CO₂ emissions may transform the captured CO₂ into oil and from Oil natural gas will be extracted along with other components that highly important for various industries. Oil and Gas companies may choose to cooperate with the SMEs from their foreign locations especially if they are from the exporting oil and Gas economies to boost their business and help them grow but this needs to rely on such a model and efficient strategy that lead to long-term business values. For this reason, both MNCs may need to focus on the process of de-carbonization and sustainable business for a mutual survival. This paper is part of the doctoral research and one of the chapters of its main first author, One the goals of this full paper is to come up with the mutual business internationalization cooperation model between Oil and Gas MNCs and SMEs for de-carbonization and sustainable business.

2. Literature review

2.1. National and international oil companies for the climate change mitigation

Oil and Gas companies may become active participants in the climate change mitigation but they are already considered as large contributors to the rising climate change issue. (International Energy Agency, 2021b). Deloitte (2021a) identifies four different archetypes or roles of Oil and Gas companies in the energy system transformation: green followers, low-carbon producers, hydrocarbon stalwarts and zero pioneers. (Deloitte, 2021a). In general, there are two categories of oil companies that can be related somehow to re-globalization and de-carbonization. According to Beyazay (2015) these companies are National Oil companies (NOCs) that takes over boosting national economic development and securing energy supply for their domestic markets. In contrast, International Oil companies (IOCs) that maximize and intensify shareholder return and profits. (Beyazay, 2015). Due to the high importance of fossil fuels production for National Oil Companies (NOCs) and domestic economies, National Oil Companies (NOCs) may be slow in adopting the strategy of de-carbonization but many of them are already investing in renewable energy projects and trying to explore and come up with new business models regarding this point. (Lu et al., 2019).

However, IOCs face from time to time pressure from investors and shareholders to shift and move towards low carbon technologies and renewable energy, especially where the financial risks of the stranded assets and climate change are getting more apparent. (Vieira et al., 2023).

2.2. Globalization, AI, energy, the global economy, sustainability and sustainable business

Globalization drags out behind sustainability, energy deals and the time ahead economy (Benabed and Boeru, 2023a). Energy depends on the stability of the global economy since it is considered one of its main pillars (Benabed and Boeru, 2023a). In globalization customers consume more energy so that its demand remains higher, the thing that requires always more production to satisfy the needs (Benabed and Boeru, 2023a).

Business holder and companies have to apply some sustainability strategy in order to reach sustainable values with competitiveness (Benabed and Boeru, 2023a). Companies and business holders decide to expand their business perspectives abroad through internationalization to reach a better income size and turnover (Benabed, 2023b). The company that operates in different points abroad, it becomes more trustful for customers due to its regular performance and presence for customers abroad (Benabed, 2023b).

Globalization has made markets and economies work together globally that is why it is very relevant for companies to move from an emplacement to another to internationalize their business (Benabed and Boeru, 2023b). Using artificial intelligence is very helpful and useful for the energy sector and precisely for the extraction and development of hydrocarbons. Smart grids are a rising type of artificial intelligence that helps control the level of supply and demand along with the ability to detect the level of energy consumption (Benabed, 2023c).

2.3. Multinational companies and Small and Medium Sized enterprises in globalization

Small and Medium Sized enterprises (SMEs) participate highly in local and global economies' perspectives with considerable annual turnovers and they are divers in globalization (Benabed, Miksik, Baldissera and Gruenbichler, 2022). Business resilience is highly essential as a strategy for companies and Small and Medium Sized Enterprises (SMEs) in a precise way so that they are able to cope with the risks and difficulties of local and international markets (Benabed, 2023a). Risks for companies could be geopolitical, operational, natural, political, financial, cybernetic and social. So, they affect the international process of companies in case they do not come up with resilience plans for the right moments (Benabed, 2023a). Multinational companies that make direct investments (FDIs) abroad have a direct economic influence on the economic level of the host economies in many ways including job creation, the balance of payments and the growth rates (Benabed, 2024a). Multinational companies (MNCs) may acquire Small and Medium Sized Enterprises (SMEs) in their locations (Benabed, 2024c) to convert them to some of their

subsidiaries, thus ensuring their survival or integrating them into their system (Benabed, 2024c) SMEs may grow by choosing and following the appropriate internationalization method, such as foreign direct investment providing that the three conditions of the Dunning (1988) OLI model that bases on the Ownership, location and internalization are met (Benabed, 2024c).

2.4. Global business and the move of globalization to slowbalization to the possible Re-globalization

Globalization has made markets and economies work together globally that is why it is very relevant for companies to move from one emplacement to another to internationalize their business (Benabed and Boeru, 2023b). Because of the challenges that occur in globalization, the labor market faces constantly changes and barriers that come from its dimensions that are economic, political, cultural, technological, social and environmental (Benabed, 2024b). Slowbalization can clearly be seen in the large difference between developed and developing economies (Benabed and Moncea, 2024). Besides, Slowbalization lies in the image of low-income economies that remain always weak (Benabed and Moncea, 2024). However, Re-globalization as a phenomenon is a strategy related to reshaping and expanding the global business landscape that is accompanied by the trends of globalization, decoupling and cross-border investments in the changing world. (Buckley and Ghauri, 2004; Williamson, 2021). De-carbonization is a strategy and behavior to tackle climate change and long-term energy transition in which renewable energy sources are slowly trying to replace fossil fuels. (Doh et al., 2021).

2.5. Oil and Gas companies for de-carbonization and re-globalization

Indeed, there are very few articles about the re-globalization and de-carbonization of Oil and Gas companies. Strange (1988) considers production, finance and knowledge three main aspects of internal environment and three aspects of external environment such as economic globalization, energy security and climate change and according to Bradshaw (2013) they are important aspects of the global energy dilemmas. (Bradshaw, 2013).

3. Research methodology and research questions

The research methodology started with the application of a related literature review in the study after setting the main research questions to start the research, the literature review base more on the keywords of the full paper and its content is chosen to show the compatible previous helpful published parts that are relevant to this study (see figure 6).

The analysis part has passed by illustrating the processed data in various figure for a statistic analysis that bases on data interpretation and a critical descriptive analysis for each where figure 2 illustrates the emergence of energy sources between the 15th and 21st centuries, figure 3 illustrates Global Oil and Gas employment by commodity type in 2023 in millions, figure 4 illustrates the Global demand for crude Oil from 2005 to 2024 with a 2025 forecast and figure 5 presents and illustrates Annual global CO₂ emissions from 1940 to 2024 (in billion metric tons). To answer well the questions in a coherent original way I created the model and framework in figure 6 that illustrates the business internationalization model between Oil and Gas MNCs and SMEs for de-carbonization and sustainable business to present how to apply, reach and get involved successfully in the business internationalization (see figure 6) by going for foreign direct investments choosing the multinational strategy of MNCs to multinationize the Small and Medium Sized (SMEs) of host country by either merging them or purchasing taking the case of Oil and Gas MNCs and SMEs for de-carbonization and sustainable business (See figure 6).

The set research questions for this actual research and full paper are the following:

RQ1: Will Oil and Gas remain as main energy resources for the future as business sources and economic engines?

RQ2: May Oil and Gas MNCs and SMEs cooperate for mutual survival by getting both involved in the de-carbonization process and sustainable business?

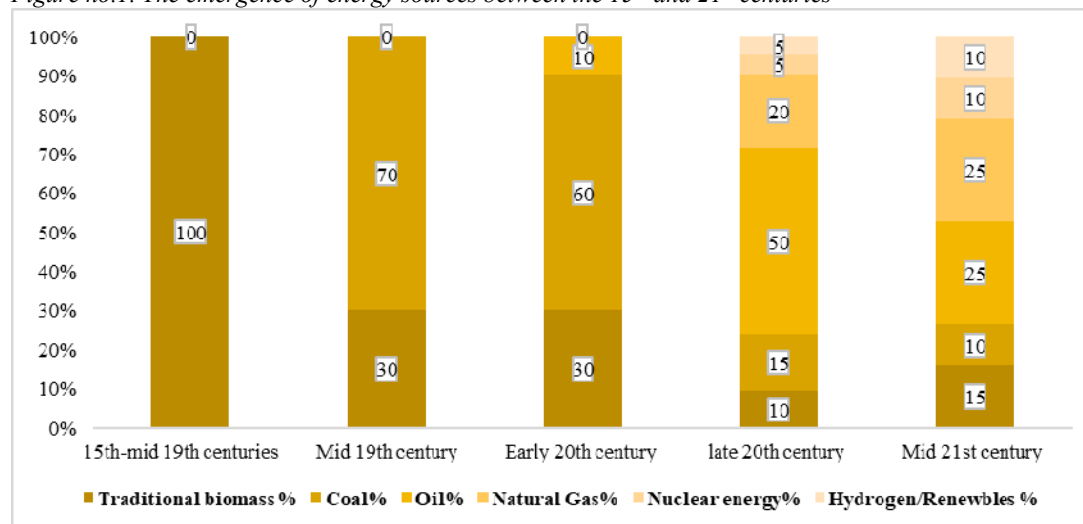
RQ3: May Oil and Gas MNCs survive the Oil and Gas business through the process of de-carbonization and sustainable business?

This full paper is one of its author's original actual doctoral research and PhD thesis' chapters in a relevant way. It is supplementary doctoral research and chapter to the previous papers by the same author and a complementary new article in international business, energy and other relevant fields where other authors had published. One of the goals of this full paper is to come up with the mutual business internationalization cooperation model between Oil and Gas MNCs and SMEs for de-carbonization and sustainable business.

4. Findings, analysis and the model

Figure 1 illustrates the emergence of energy sources between from the 15th centry to the 21st century. As illustrated in the fugure from the 15th to the mid-19th century traditional biomass energy was dominating the world of energy with 100% use based on woodfuels for heating and cooking (see figure 1). In poor countries, the biomass energy is still used and harvested unsafely for various reasons. Moving with time from the mid-19th century to the early 20th century, coal emerged as a new source of energy with 70% use and important whereas the use of traditional biomass decreased from 100% to 30% due to the domination of coal (see figure 1). From the early 20th century to the late 20th century Oil apeared as a new source of energy but with 10% existence and use compared to 60% of coal and 30% of traditional biomass, oil faced difficulties of extraction due the lack of suitable technology for its operation and extraction. From the late 20th century to the mid 21st century Oil raised in importance and domination to 50% worldwide but the traditional biomass and coal's energy domination decreased to 10% and 15% each sepatatly (see figure 1).

Figure no.1. The emergence of energy sources between the 15th and 21st centuries



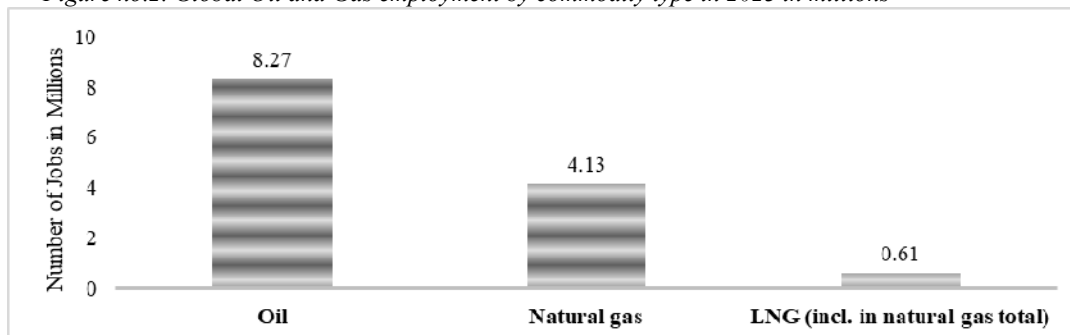
Source: Author's own design and research, 2023-2025

New resources appeared in the late 20th centured such natural gas that had a 20% energy domination, nulear energy with 5% along with hydrogen and renewable energies with 5%, the same energies has remained so far as energy resources. From the mid-21st until the present time the importance of Oil and gas equilazed together with 25% ech but Oil remains the major energy resource globally since from it we get get natural gas as well.

Coal's importance decreased due to its weak performance and benefits to 10%. Nonetheless, nuclear energy together with hydrogen and renewable energies equalized with 10% each (see figure 2). Figure 2 presents the global Oil and Gas employment by commodity type in 2023 in millions. As oil, natural gas and liquefied natural gas commodities, they have been for important for the labor market globally and locally. The larger number of employees in the global oil and gas industry comes from the oil sector. As for 2023, around 8.27 million individuals were hired

globally in the oil sector and this out of the total number of the three energy sectors 13.11 million individuals (see figure 2). If we take the natural gas sector globally, we observe that 4.13 million individuals were hired in the natural gas sector (see figure3). However, only 0.61 million people were hired in 2023 according to the available data mentioned in figure 2.

Figure no.2. Global Oil and Gas employment by commodity type in 2023 in millions

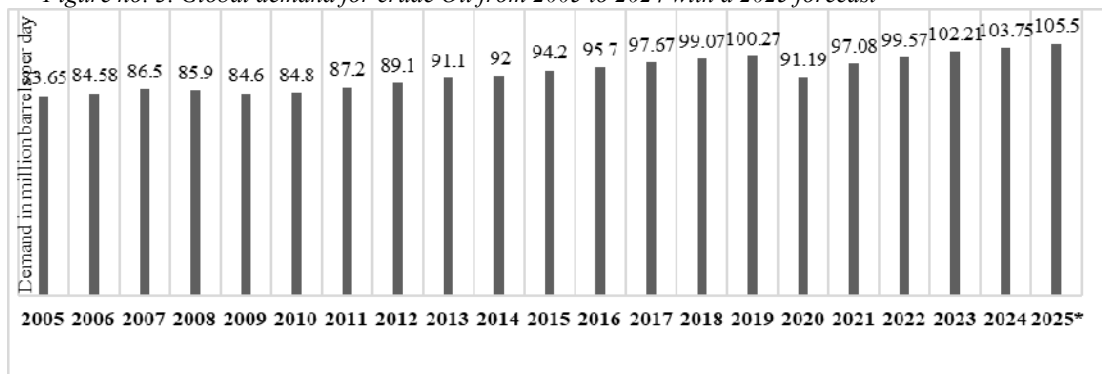


Source: Author's contribution 2024, International Energy Agency data 2023, Statista data 2023

Overall, the main energy sector of employees is the oil sector, and this is due to its high importance to the global economy, oil remains the main source of energy worldwide because it provides the world with different benefits from industry to business and vice versa (see figure 2).

Figure 3 illustrates the global demand for crude Oil in million barrels per day from 2005 to 2024 with a 2025 forecast using the available data (see figure 3). We observe that the global demand for crude oil in the mentioned period has been increasing constantly, back to 2005 it was 83.65 million barrels per day and this is a huge amount for the history of oil, for upcoming years it had been raising slightly until it reached 100.27 million barrels per day in 2019, then, it decreased a bit after the outbreak of the epidemic period caused by COVID-19 (see figure 3).

Figure no. 3. Global demand for crude Oil from 2005 to 2024 with a 2025 forecast

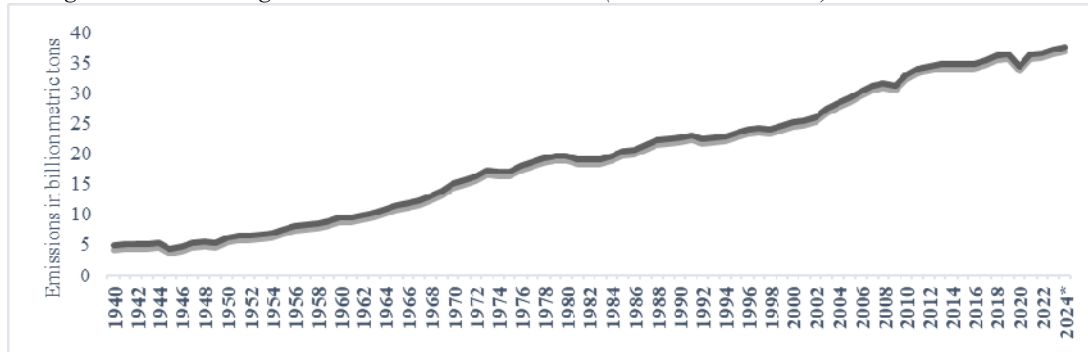


Source: Author's contribution 2024, OPEC data 2024, Statista data 2023

In 2020 the global demand was 91.19 million barrels per day and this year of the decline but not too much and that means that oil is the main global energy engine worldwide and it is like water, the global economy cannot do without oil (see figure 3). The global demand started to increase again during the 2021 year of recovery to 97.08 million barrels per day (see figure 3). The global demand for crude oil in 2024 reached 103.75 million barrels per day and it is increasing years due to its relevance and raising role global economy (see figure 3).

Figure 4 illustrates the annual global emissions of carbon dioxide from 1940 to 2024 according to the available data. So, the biggest contributors to global greenhouse emissions are mainly the US and China since are the largest economies on earth but this does not exclude all the advanced economies that produce their developing countries either in their territories or abroad through the business internationalization aspects of their multinational companies and other ones engaged in business and energy (see figure 4).

Figure no. 5. Annual global CO₂ emissions 1940-2024 (in billion metric tons)



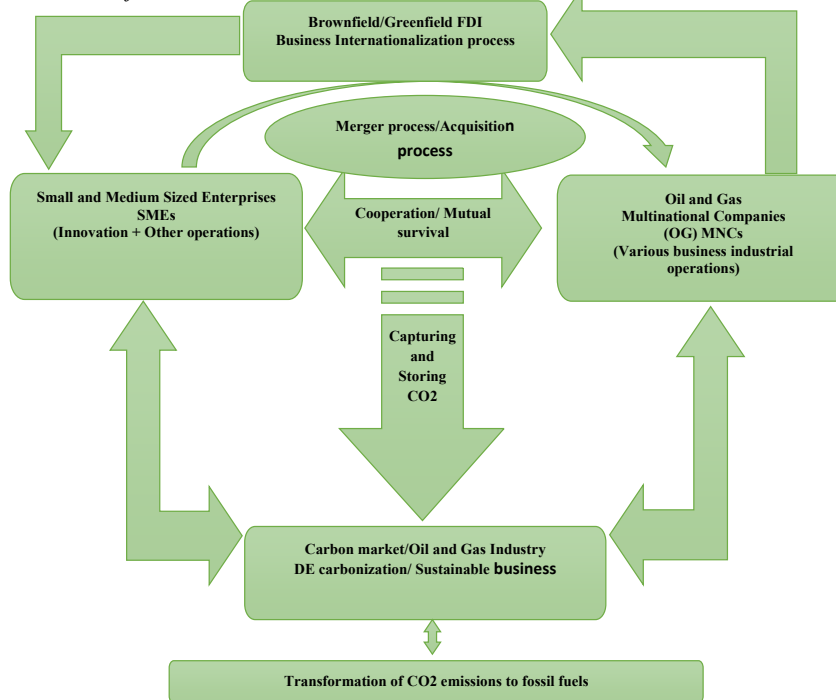
Source: Author's contribution 2024, Global Carbon Budget data 2024, Statista data 2024

The epidemic breakout and sudden appearance of COVID-19 led the CO₂ emissions to plummet in 2020 due to the lockdown, global industrial economic activities and other restrictions. Another remarkable collapse of CO₂ emissions is observed on figure 5 in 2009 during the global economic recession caused by the global financial crisis of 2008 but not with the same value (see figure 4). Back to the history and evolution of globalization even in 1980 there was a decline and low presence of CO₂ emissions due to certain global events that had a notable impact on the CO₂ emissions and led them to plummet (see figure 4). However, the largest and lowest annual reduction was at the end of the Second World War in 1945 (see figure 4). Therefore, the global collapse and reduction of CO₂ emissions is well associated with the global and local economic activities that could be more industrial based on burning fossil fuels (see figure 4).

Figure 5 illustrates the mutual business internationalization cooperation model between Oil and Gas MNCs and SMEs for decarbonization and sustainable business. This model is created by the author of this full paper and research for companies and business holders that choose the internationalization process to multinationalize their business across the borders. The model can be used for all types of multinational companies (MNCs) that choose to cooperate and merge the Small and Medium Sized Enterprises (SMEs) from their foreign locations for business values and extension within the internationalization process (See figure 5).

As illustrated in the figure, Oil and Gas multinational companies that choose to enter foreign markets or that deal with them within the internationalization process through foreign direct investments (FDIs) may choose any of the three types of FDIs of all of them depending on the compatible possibilities with foreign locations (see figure 5). Multinational companies may choose between Greenfield, Brownfield or the merger process of FDIs. If the MNCs chooses Greenfield FDI, it starts everything for zero by introducing its facilities and building up their business in foreign locations. If the MNCs choose the Brownfield FDIs, they may purchase through their headquarters or government entities existing facilities in foreign locations and join them to their business strategy and this is possible for the case of SMEs in case they offer their facilities to be bought by MNCs due to business losses or other reasons (see figure 5). The third type of FDIs that is very suitable for Oil and Gas multinational companies is the merger process where they may merge foreign companies for their foreign locations and they could be SMEs because they are the engines of many economies globally. MNCs may cooperate with them for a mutual survival that may work for both sides. In other words, MNCs may multinationalize those SMEs and help them survive through the merger process, while SMEs may help them to survive the business risks of foreign locations (see figure 5). Both MNCs and SMEs may collaborate in the carbon market within the business internationalization process in the carbon market in boosting the oil and gas industry through the process of de-carbonization and sustainable business. Innovative SMEs are more helpful in the merger process and may be multinationalized according to this research (See figure 5).

Figure no.5. The mutual business internationalization cooperation model between Oil and Gas MNCs and SMEs for de-carbonization and sustainable business



Source: Author's design and doctoral research, 2025

5. Conclusions

Oil and Gas multinational companies that choose to enter foreign markets or that deal with them within the internationalization process through foreign direct investments (FDIs) may choose any of the three types of FDIs of all of them depending on the compatible possibilities with foreign locations (see figure 5). Multinational companies may choose between Greenfield, Brownfield or the merger process of FDIs.

This full paper has answered all the set the research question in the section of methodology Oil and Gas will never end, they will remain as main energy resources for the future since they are business sources and economic engines, Oil and Gas MNCs may survive the Oil and Gas business through the process of de-carbonization and sustainable business, Both Oil and Gas MNCs and SMEs may cooperate for a mutual survival by getting both involved in the de-carbonization process and sustainable business. If the MNCs choose the Brownfield FDIs, they may purchase through their headquarters or government entities existing facilities in foreign locations and join them in their business strategy and this is possible for the case of SMEs in case they offer their facilities to be bought by MNCs due to business losses or other reasons (see figure 5). Otherwise, they merge them through the FDI merger process. Both Oil and gas industries and Co2 emissions have been impacted up to present especially during the period of Covid-19 and other periods mentioned in figure 4. Oil and Gas are drivers of the globalization process and business internationalization globally. Companies and business holders reply on their values to further in their business endeavors (See figures 1, 2, 3, 4 and 5).

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Deciphering the Applicability of Marketing for Companies' Ownership and Business Internationalization as Key for Market Leadership

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Abstract

This paper and research present, analyze and decipher the relevance of the applicability of marketing in the companies' business internationalization process for market leadership. Companies and business holders that would like to operate in foreign markets through the internationalization process have to focus on the power of their brands and ownerships using the powerful concept of marketing but they have to break its codes wherever and whenever they use it. Companies often face significant challenges when they expand internationally, such as understanding local consumer preferences and adapting product offerings and marketing messages. However, Effective marketing strategies enable companies to capitalize on these opportunities by identifying target markets, conducting market research, and developing tailored advertising campaigns. In conclusion, marketing has to analyze global ideas for international markets because it is very important for companies' local and international business perspectives within or before engaging in the business internationalization process.

Key words: business internationalization, globalization, marketing, brand, process, insight, decoding

J.E.L. classification: M0, M13, M31, F23, F60, F64

1. Introduction

Globalization has been running the world since its emergence in the 18th century with the rise of the 3rd industrial revolution. As it has brought all the world's economies together, it has divided them as well by leading them to inequality in everything given that it divided the world between developed and developing economies. Globalization has been driving the world's economies for ages through its economic, social, cultural and political dimensions, its economic dimension has been growing creatively following different gathered perspectives among the world's economies. Moreover, the digitalization and internationalization processes emerged in globalization and have been developed by companies in different ways. Currently, globalization as I analyzed and presented in some of my previous published full papers has been in a slowdown for more than a decade, this slowdown that is its current phase and called de-globalization has been affecting the movements of business and energy globally due to various aspects. The concept of marketing has passed by different styles from writing on the wall and oral announcements and advertisements before globalization and during its first stages to other ways that could attract the clients' attentions. In other words, after the emergence of the digitalization process, the concept of marketing has been so relevant for companies' business.

Marketing has to analyze global ideas for international markets because it is very important for companies' local and international business perspectives within or before engaging in the business internationalization process. However, it faces ups and downs due to the fact that many business holders and companies do not know how to use the power of marketing to star their business and reach competitive advantages. Various companies center more on sales and production without controlling their relationships with the clients during their business operations especially when they internationalize and operates in foreign locations, the thing that impacts more their business benefits and long term existence in various markets. Internationalizing business through any of the

internationalization strategies that the company follow and apply to operate abroad requires some methods of adaptability because faces various obstacles such the degrees and types of cultures, clients' preferences, countries policies, religious and social limitations, regulations and other aspects. Thus, if the companies does not know how to deal with customer and reach their satisfactions through it's the process of marketing, it loses its credibility before them.

The concept of marketing has to base on different values including the cultural language values that are very relevant because if the company cannot impose its language on clients from different markets and locations where it operates, it has to cooperate by using a common langue and a correct way to reach a satisfying relationship in markets. Some companies have got rising brands various acceptable facts valued by the clients' preferences. The goal of this full paper is to decode the importance and relevance of marketing for companies' brands and business internationalization process by analyzing and presenting the importance of brands, the power of marketing and customer values for companies and business holders that are engaged or would like to get involved in the business internationalization process. This paper is an original study and actual research, it is part of its author's doctoral research as one of its PhD chapters, it analyzes various supplementary aspects that complete what has been published by its authors previously, it is a helpful analytical approach for companies and business holders that would like to operate in foreign markets through the internationalization process by focusing on the power of their brands and ownership using the concept of marketing but they have to break its codes wherever and whenever they use it.

2. Literature review

Globalization has steadily and circumspectly configured the world over the centuries and it rose among various waves of industrialization. It has driven the world and human society to evolve from simple energy sources such as coal and wood to fossil fuels globalizing societies and economies (Benabed and Boeru, 2023). By degrees, it has globalized the energy market and various other markets. Globalization introduced both internationalization and digitalization as main instruments for its processes and dimensions (Benabed and Boeru, 2023).

Business internationalization enables firms to expand their activities into overseas markets and foreign economies (Benabed, 2024a). The internationalization process via exports may encounter barriers like customs requirements or mandatory certifications to ensure products are not held by authorities (Benabed, 2023b). The steadiness of a business depends on the level of production, services, goods, market trends and customer confidence, which are the main elements of business in the economy. Put differently, the steadiness of a business depends on the steadiness of the economy (Benabed, 2023a).

FDI-driven internationalization is shaped by ownership, location, and internalization factors (Benabed and Bulgaru, 2023),

Marketing skills are a relevant key factor to reach any competitive advantage and boost the business performance within the company especially when it comes to sustainability (Morgan and Slotegraaf, 2022). Back to the previous decades, a lot of business to business companies used to incorporate the marketing abilities in a significant way (Cortez and Hodalgo, 2022). Nonetheless, there has not been a lot of attention regarding the implementation of marketing skills for business to business models and business to company's strategy (Morgan and Slotegraaf, 2022). Using marketing skills in a creative way may help reach efficiency in the companies' resource utilization and lead to a sustainable business competitive advantage (Wiles et al., 2012). Thus, identifying the key competencies of marketing that need to be developed is an important point in entering competitive markets (Guo et al., 2018).Some prior research have mentioned the key role of artificial intelligence (AI) in developing the marketing abilities since such technology is driving business everywhere (Manis and Madhavaram, 2023).

The link that associates marketing with internationalization has been a subject of extensive research as marketing has been recognized as a key factor in corporate internationalization (Kotler, 2012). as firms expand beyond their domestic borders, marketing is often the first point of contact with foreign markets. Successful international marketing strategies hinge on the ability to understand and cater to local market demands while maintaining a consistent global brand image. The concept of "international marketing" has evolved significantly in response to globalization.

According to Palmer and McDonnell (Palmer and McDonnell, 2021), international marketing is characterized by the necessity to adapt marketing strategies to the cultural, economic, and legal differences across global markets. The need for businesses to understand these variations and incorporate them into their strategies is critical. At the same time, globalization has led to the development of global brands, which, while rooted in a uniform product offering, often require marketing adjustments to meet local needs and preferences. As Porter (1990) suggests, competitive advantage in international markets arises from a firm's ability to understand and leverage local market conditions. Marketing strategies that are both globally consistent and locally responsive are essential for success.

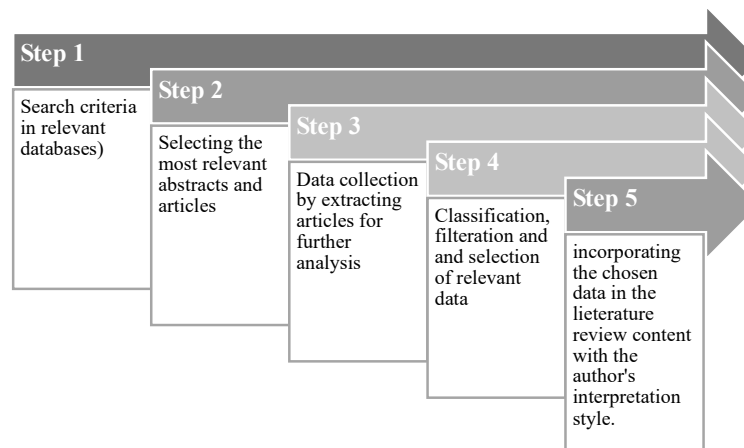
For example, Coca-Cola has long been a successful example of a brand that has successfully implemented an international marketing strategy. The brand is consistent globally, but its marketing messages and product offerings vary to meet the needs of different cultures. In some countries, Coca-Cola uses localized advertising to connect with the emotional and cultural values of the target market. This global-local approach is a key feature of successful international marketing strategies (Palmer and McDonnell, 2021).

3. Research methodology

The research methodology relied first on a related literature review to this research and actual study, its literature review went through an analytical approach structure basing on the relevant prior research to our keywords and study.

As illustrated in figure 1, that illustrates the literature review steps and search criteria according to the author's perspectives, the literature review passed by five main steps where the first sept was for searching criteria in the relevant databases, the second step was for selecting the most relevant abstracts and published articles. The third step was for data collection and the fourth step was for the classification, filtration and selection of the relevant data. The fifth step was for incorporating the chosen data in the literature review content with the author's interpretation (See figure 1).

Figure no.1. Literature review steps according to the author's perspectives



Source: Author's design and research, 2025

As this study is very actual, it has not been easy to find enough previous publications that could be relevant to our topic but we could create a structural form for it. Second, for coherent statistic data interpretation, in the section of results they are illustrated in figure 2 and 3 where figure 2 represents the most valuable brands by 2025 according to the available data in billion US dollars, figure 3 illustrates the influencer marketing market size worldwide from 2015 to 2025 in billion U.S. dollars, figure 4 illustrates a created framework to an advantageous marketing for business internationalization in companies (See figure 2 and 3).

At the end, I designed the model and framework in figure 5 to illustrates how companies and business holders may reach and focus on customers' value within/for the business internationalization process through the power of marketing (See figure 5). So the research method is a mix of quantitative qualitative approach based on creative critical analysis.

To start well the research in a coherent way, there were set the two research question that are below:

RQ1: What are the business values of marketing for companies' brands and business internationalization in globalization?

RQ2: How relevant is marketing to the business internationalization process in globalization? And what makes customers stick with a particular brand or product?

4. Analysis and results

4.1. Marketing relevance and the scope of business internationalization

Many companies choose to enter international markets for various reasons, as their business offers numerous advantages focusing on brand awareness and recognition, ensuring greater project stability, diversification of markets and customers, availability of more qualified and motivated resources and employees, reinvestment of profits with compensation for achieved results.

By investing in internationalization, companies of all sizes and industries may find various opportunities outside their national markets thanks to digital tools such as digital marketing and social media for networking with customers and stakeholders since digital marketing is one of the most important drivers of internationalization.

There are several factors that motivate them, but three are the main ones. First, the push factors are when the saturation of professional markets generates the need to seek new larger markets or other causes that are unfavorable for the business in the home country. Second, the pull factors, which seek opportunities in new markets through competitive advantages among competing countries, customers, or suppliers. Third, technological advances that facilitate the leap, or state aid or subsidies.

4.2. Marketing and International Business for values

In fact, the knowledge of how to reach customers from another country and culture can be acquired through marketing in the internationalization process.

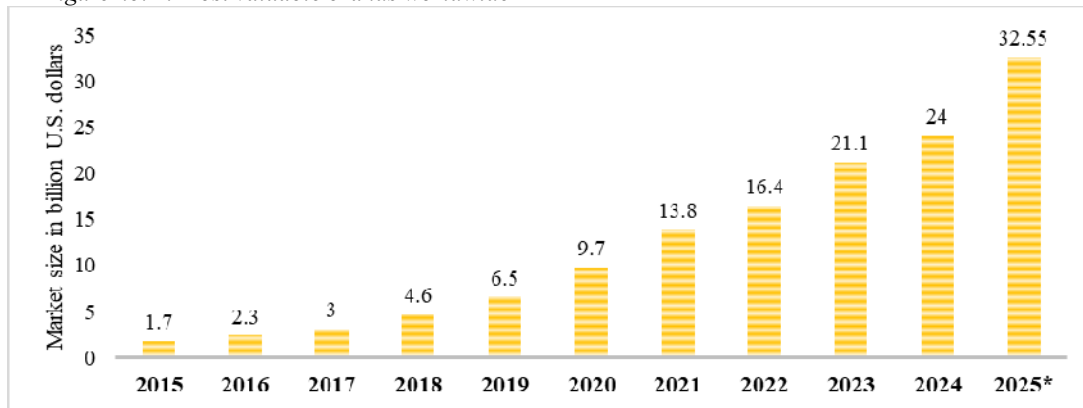
According to Philip Kotler's theory, international marketing is divided into four main components, the so-called marketing mix. Kotler (2012) states that the product encompasses everything related to the characteristics and appearance of the offering; the price or quantity proposed by the seller and accepted by the buyer; distribution or placement, the product's path from the exporter to the final consumer abroad (Kotler, 2012). Finally, communication encompasses all the formulas used to persuade the customer to purchase the product (Kotler, 2012). All of this is incorporated into an international marketing plan, in which the company analyzes its environment and establishes a set of objectives and strategies that are translated into actions within a budget to achieve the planned sales targets (Kotler, 2012).

According to this research and full paper, international marketing is defined as a company's strategy to ensure that consumers of its products or customers of its services worldwide recognize, appreciate, and purchase its offerings repeatedly and loyally. This is achieved by making purchasing products easy and convenient while providing compelling reasons for choosing the offering. The most important aspect of international marketing for companies is therefore the customer, and our understanding of them has changed over the past few decades for various reasons. Meeting their needs is not easy; it requires considerable intelligence, perseverance, creativity, and innovation.

4.3. Analysis of data and global brand values and the global marketing influencer market

Figure 2 represents the most valuable brands by 2025 according to the available data in billion US dollars. The Chinese State Grid Company has got the lowest brand value with 85.6 but this this appreciated among all from the presented list. The American multinational Company “Nvidia” that deals with electricity products came before it with a brand value of 87.9 billion US dollars (see figure1). The highest brand value lies in the American multinational company „Apple” with a value of 574.5 billion US dollars followed by the other American multinational company “Microsoft „with a value of 461.1 billion US dollars. The American multinational company “Google” came third globally by 2025 with global brand value of 413 billion US leadership due to its strong leadership in technology opportunities (see figure 2).

Figure no. 2. Most valuable brands worldwide

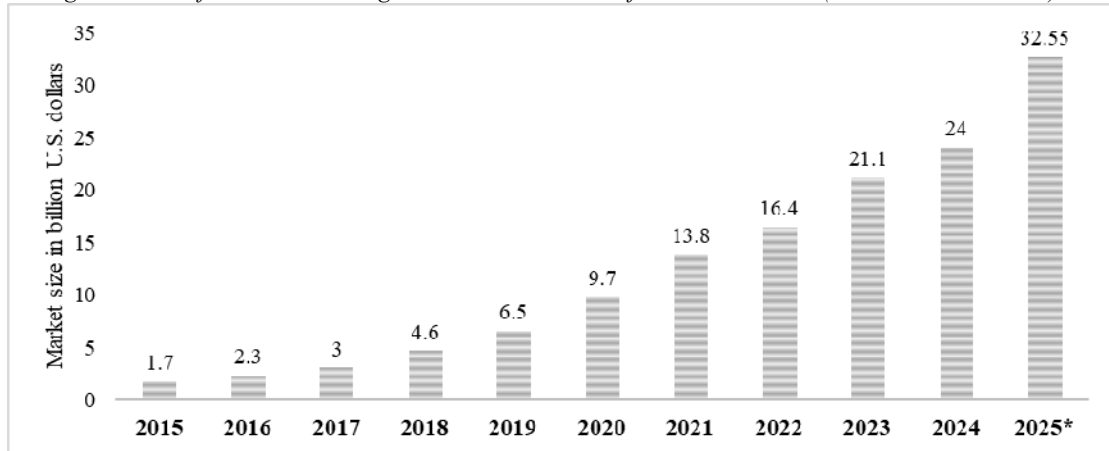


Source: Authors' contribution based on Brand finance data, 2025

Amazon as another American multinational company is in the fourth place with a 356.4 billion US dollars as a brand value, Amazon is a multinational company for e-commerce technology and computing that has got a high sale level. Whereas “Walmart” the American multinational company of retails is in the fourth place with a brand value of 137.2 billion US dollars, Walmart has got a series of hypermarkets globally with a very creative leadership (see figure 2). Most American companies are in the lead globally with their valuable brand values including “Facebook” that a multinational American technology company has got a 91.5 billion US dollar brand value but it is still after the Chinese state company “Tik Tok” that has a close global brand value valued as 105.8 with a seventh leadership position by 2025 (see figure 2). The South Korean Multinational Company “Samsung” has come seventh in the offered studied list of brand values by 2025. From this analysis, there is a strong observed Global business leadership position and internationalization process, the strongest brand values come from the United States of America due to the quality of politics and support to multinational companies in international business. However, the Chinese companies are observed only as state global companies due the national policy they abide by but they have also a strong weight globally in the era of business internationalization, they just use other entry modes and collaboration styles with foreign markets and since China is a global market and engine for world production, it does not produce outside to protect its global leadership position and the reality is seen in many products that are made of assembled in China (figure 2).

Figure 3 illustrates influencer marketing market from 2015 to 2025 in billion US dollars, according to the provided illustrated data, it is observed that the influencer marketing market has been increasing well for the observed decade 2015-2025 with the highest value in 2024 with 24 billion US dollars and higher in the first quarter of 2025 with a value of 32.55 billion US dollars (see figure 3).

Figure no. 3. Influencer marketing market size worldwide from 2015 to 2025 (in billion U.S. dollars)



Source: Author's contribution, influencer marketing hub and Statista data, 2024-2025

Influencer marketing is a form of social media marketing that involves product placement and advertising promotion by online creatives. In today's competitive marketing environment, brands are collaborating with influencers more than ever, as partnerships with well-known creatives can open the door to large potential audiences. In 2015 the value of the influencer marketing market was very low and valued as 1.7 billion US dollars but the value has been increasing gradually (see figure 2) due to various factors including the driving forces of globalization, internationalization and digitalization that have pushed the influencer marketing market ahead since a very important worldwide progressive business.

4.4. A framework for an advantageous marketing for the companies' business internationalization

Figure 4 presents a designed framework for an advantageous marketing and its positive sides for the companies' business internationalization and internationalizing brands worldwide. Marketing for business internationalization is highly important because according to this research and analysis, it leads companies and business holders to less competitions since applying marketing in business with the internationalization process leads to make the company's image everywhere using the power of digitalization (see figure 4).

It formulates and structures a strong network with customers by keeping their attention and eyes on the new of the company's business, operations, services or industrial movements, it stabilizes the company's business and strengthens its profitability for long terms since it works more on the customers fidelity process that is a very important point in the area of internationalization and business in particular (see figure 4).

Other helpful points that come from applying such an advantageous marketing in international business is the possibility of risk reduction an anticipation through the degree of advertisements (see figure 4). Therefore, it is a very important point for the company's business options and design since it leads to more market attraction and this is highly observed in the analysis of figure 2 and 3.

Figure no. 4. A framework for an advantageous marketing for business internationalization in companies



Source: Authors' design and research, 2025

4.5. Optimizing the link between marketing and customer value

Companies that internationalize or would like to operate abroad through the internationalization process should focus more on the customers' values in its foreign locations and markets because customers are the ones that value its brand and ownership until they stick with them if meet their needs and expectations (See figure 5). Indeed, Customer value is essentially the perceived benefit that a customer gets from using a product, service or experiencing something that any company or business offers. In other words, it is about how much customers value what they get compared to what they pay for. This concept is crucial because it impacts how much money customers would like to spend.

Companies aim to optimize the customer value all through the whole customer journey (See figure 5).

As illustrated in figure 5 companies and business holders may reach the customers' value by using the relevant power of marketing the right way by focusing on lowering the costs of products, services and operations, Using high quality materials in business process, respecting the customers' preferences, respecting customers' cultures and confidentiality, adapting the business with the regulations negotiating that with the stakeholders, satisfying the clients helps the company reach the market leadership and boost its brand, applying and focusing on the power of AI in marketing for business values, making sure that the tangible benefits match with customers' perceives ,respecting and protecting the customers' data with the business internationalization process, engaging customers in developing the company's business and engaging customers in the companies' sustainable business (See figure 5).

Figure no. 5. Reaching and focusing on customers' value within/for the business internationalization process through the power of marketing



Source: Author's own design and research, 2025

Thus, this requires apprehending and taking in the customer needs, proclivities and feedback is requisite for creating personalized experiences (See figure 5). As a matter of fact, companies may utilize surveys, interviews or questionnaires and data analysis to accommodate the marketing efforts by imparting relevant offers that resonate with individual customers. Furthermore, customer values may be increased in various ways though lowering the costs of their products, services or operations, using high quality materials, adding new features to the products, making sure that the tangible benefits match with the customer perceives as valuable (See figure 5). Therefore, following all these quality steps helps solidify the companies brand and ownership. Companies that prioritize customer values may foster fidelity and appreciations among their customers because if they need to boost their business reputations and reach business leadership positions in local and foreign markets, they should build long term relationships with by increasing their satisfactions. So, delivering a valuable experience with customers keeps them stick with the companies' brands (See figure 5).

5. Conclusions

Internationalization refers to the process by which companies expand their business operations into foreign markets. It is a complex and multifaceted process that requires careful planning and strategy. Marketing plays a fundamental role in this process. It helps companies navigate unfamiliar markets, understand consumer behavior, and communicate effectively with international audiences. Companies often face significant challenges when expanding internationally, such as understanding local consumer preferences and adapting product offerings and marketing messages. However,

internationalization also offers companies the opportunity to enter new markets, diversify their revenue streams, and gain a competitive advantage. Effective marketing strategies enable companies to capitalize on these opportunities by identifying target markets, conducting market research, and developing tailored advertising campaigns. Hence, customer values may be increased in various ways though lowering the costs of their products, services or operations, using high quality materials, adding new features to the products, making sure that the tangible benefits match with the customer perceives as valuable.

Therefore, following all these quality steps helps solidify the companies brand and ownership. Companies that prioritize customer values may foster fidelity and appreciations among their customers because if they need to boost their business reputations and reach business leadership positions in local and foreign markets, they should build long term relationships with by increasing their satisfactions. So, delivering a valuable experience with customers keeps them stick with the companies' brands. To sum up, there are real business values that come from the power of marketing for companies because it boots their brands, ownership business internationalization in globalization, According to this research and full paper marketing is very relevant for the companies' business internationalization process in globalization. However, it has to link customers' values to the companies' aspects so that they stick with their particular brand or product.

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The Influence of Foreign Direct Investment on the Inflation Rate in Romania: A VAR Approach

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Abstract

This study examines the relationship between inflation and foreign direct investment (FDI) flows in Romania, based on international standards from BPM6 and OECD BD4.

Using quarterly data from Q1 2013 to Q1 2025, sourced from the National Bank of Romania and the National Institute of Statistics, the paper analyzes the relationship between inflation and foreign direct investment flows in Romania, focusing on both inward FDI (by non-residents) and outward FDI (by Romanian residents). To capture the dynamic relationships between these flows and the inflation rate, a Vector Autoregressive (VAR) model was applied. This approach allows for the identification of short-term lagged effects and reciprocal influences between capital movements and price developments.

The results reveal significant impacts of FDI flows on inflation rates, highlighting how foreign capital influences monetary policy and price stability in an emerging economy. These empirical findings support the formulation of policies aimed at attracting sustainable investment.

Key words: FDI, Inflation, VAR model, Romania

J.E.L. classification: E31, E37, F21, C32

1. Introduction

Based on the latest international methodological standards outlined in the Balance of Payments Manual (BPM6) and the OECD Benchmark Definition of Foreign Direct Investment (BD4), *Direct investment is a category of cross-border investment associated with a resident in one economy having control or a significant degree of influence on the management of an enterprise that is resident in another economy* (EUROSTAT, 2025; OECD, 2025).

Within the framework of globalization, foreign direct investment (FDI) is a frequently examined phenomenon, often associated with economic growth (Horobeț and Popovici, 2017). FDI is usually quantified by its flows and stocks, which are influenced by numerous factors. These factors determine how appealing a country or region is to such investments, whether in the short run or over an extended period.

Inflation is a complex economic phenomenon with direct implications for macroeconomic stability and population welfare. In a globalized context, capital flows, particularly direct investments by residents and non-residents play an increasingly important role in shaping price dynamics. Romania, as an emerging economy integrated into the European financial system, is exposed to both outward and inward foreign direct investments, which can influence aggregate demand, the exchange rate, and, consequently, the inflation rate.

This study aims to investigate the relationship between inflation and foreign direct investment flows, both in terms of residents' investments abroad and non-residents' investments in Romania. Using a Vector Autoregressive (VAR) model, the research examines the lagged effects of these flows on the inflation rate across multiple time periods. In doing so, the paper contributes to a deeper understanding of the mechanisms through which foreign capital may influence monetary policy and price stability in a transitional economy.

In order to investigate the relationship between foreign direct investment and inflation within a dynamic macroeconomic context, this research formulates the following questions and hypotheses, aiming to highlight the differential impact of the components of international capital flows:

RQ1: What is the short-term relationship between inward foreign direct investment in Romania and the inflation rate?

RQ2: To what extent do outward investments made by Romanian residents influence the short-term evolution of inflation?

Based on these research questions, the following hypotheses are formulated:

#H1: There is a short-term relationship between inward foreign direct investment (FDI) in Romania and the inflation rate.

#H2: There is a short-term relationship between outward foreign direct investment (FDI) made by Romanian residents and the inflation rate.

The statistical analysis highlights the estimated coefficients capturing the influence of investment flows on inflation, along with their significance level, thereby providing a solid empirical foundation for economic policies focused on attracting sustainable investment and mitigating inflationary pressures.

2. Literature review

For the literature review, we have observed an interesting approach on the inflation in the "Quantity Theory of Money". The relationship between monetary aggregates and inflation has been extensively examined in economic literature, primarily through the lens of the quantity theory of money. This theory asserts that, in the long run, changes in the nominal money stock lead to proportionate changes in the price level, assuming nominal homogeneity (McCallum and Nelson, 2010).

Another impactful study was conducted by Jui et al. (2024) investigating these relationships in Bangladesh, Pakistan, and Sri Lanka using a combination of traditional and advanced econometric methods. Employing the Augmented Dickey-Fuller (ADF) test for stationarity, Vector Autoregression (VAR) for dynamic interactions, and the BEKK-GARCH model to capture volatility spillovers, the study reveals mixed outcomes. While the VAR model found no significant long-run impact of REM, FDI, and IR on GDP in Bangladesh and Sri Lanka, Pakistan demonstrated notable dependencies on these variables, particularly REM and FDI. Additionally, the BEKK-GARCH framework unveiled both unidirectional and bidirectional volatility transmissions among the macroeconomic variables, indicating that traditional VAR approaches may inadequately reflect time-varying volatility in emerging markets. These findings underscore the importance of incorporating volatility modeling in economic policy analysis, particularly for countries prone to macroeconomic instability. The research further suggests that over-reliance on FDI or remittance inflows can increase vulnerability to external shocks, a cautionary insight for policymakers in similarly structured economies.

3. Research methodology

The analysis was conducted on a quarterly dataset spanning from Q1 2013 to Q1 2025. Using the datasets available on the websites of National Bank of Romania (BNR, 2025) and National Statistics Institute of Romania (INS, 2025) we have selected the data for Foreign Direct Investments Stocks and Flows, and the Inflation Rate. Due to the lack of available data on the Inflation Rate on the INS website, I used the available inflation forecast data for the years 2024 and 2025 provided by NBR (BNR, 2025; INS, 2025).

The initial step involved visualizing the time series data for each variable: Direct Investments; Investments of residents abroad (million Euros) – stocks, Direct Investments; Investments of non-residents in Romania (million Euros) – stocks, Direct Investments; Investments of residents abroad (million Euros) – flows, and Direct Investments; Investments of non-residents in Romania (million Euros) – flows. These variables were analyzed in conjunction with the inflation rate. Explanatory data analysis was also conducted.

Subsequently, an attempt was made to conduct a cointegration analysis; however, based on the results of the Augmented Dickey Fuller (ADF) stationarity tests, it was determined that this approach was not feasible. Therefore, the decision was made to proceed with a Vector Autoregression (VAR) model.

To test whether a time series is stationary, i.e., has constant mean and variance over time, the two hypotheses were tested:

H_0 : The series has a unit root (non-stationary). H_1 : The series is stationary.

The ADF test examines whether a time series contains a unit root, which implies non-stationarity, the test equation is: $\Delta y_t = \alpha + \beta_t + \gamma y_{t-1} + \sum_{i=1}^k \delta_i \Delta y_{t-i} + \varepsilon_{t,t}$ where, γ is the coefficient testing for the presence of a unit root. If the $p - value < 0.05$, reject the null hypothesis H_0 , concluding the series is stationary. If the $p - value \geq 0.05$, fail to reject H_0 , meaning the series is non-stationary (Stock and Watson, 1988; Campbell and Perron, 1991).

4. Findings

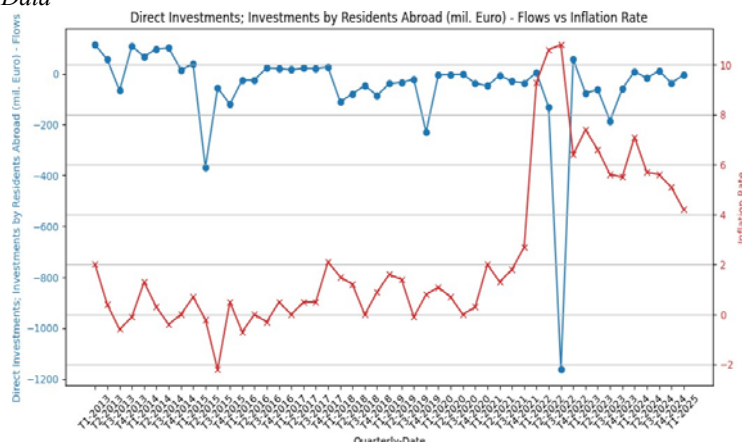
The most important variables specifically to our analysis are The Investments of Romanian Residents in Foreign Countries, and The Investments of Foreign Residents to Romania, so we decided first of all to explain the descriptive statistics for these variables, with the following results:

Table no. 1. Descriptive Statistics for Outward FDI by Residents (million EUR, flows)

Indicator	Value
Mean	-48.87
Standard Error	26.16
Median	-21.53
Standard Deviation	183.13
Sample Variance	33,538.11
Kurtosis	29.38
Skewness	-4.95
Range	1276.27
Minimum	-1162.35
Maximum	113.92

Source: own work, using Microsoft Excel

Figure no. 1 Outward FDI by Romanian Residents (million EUR, flows) vs. Inflation Rate – Quarterly Data



Source: own work, using Python

On average, the net flows of direct investments by residents abroad are negative, indicating more investment withdrawals. Half of the observations are below -21.53 million Euros, suggesting the median is less negative than the mean, so we could further investigate specific outliers, suggested also by high negative skewness, meaning there are significant extreme negative values.

The series exhibits a general negative trend, reflecting net negative direct investment flows. There is very high volatility with extreme fluctuations during the observed period. The distribution is highly skewed to the left, indicating the presence of significant large negative shocks or disinvestments. The heavy tails (high kurtosis) suggest that extreme events occur more frequently than would be expected in a normal distribution.

This series (Figure no. 1) demonstrates high volatility over time, with frequent and pronounced fluctuations between positive and negative values. There are periodic recoveries, but these are generally smaller in magnitude compared to the negative outliers. The minimum value (-1,162.35) suggests a pronounced capital outflow, possibly linked to economic or financial instability during that period.

During the analyzed period, Romania received an average of approximately 1,327.7 million EUR in inward foreign direct investment flows from non-residents. The positive skewness (0.72) indicates a right-skewed distribution, with most values clustered around the mean and influenced by a few significantly large inflows. The slightly positive kurtosis suggests a distribution that is more peaked at the center and has heavier tails than a normal distribution, yet without extreme outliers. Overall, the data reflect a steady and relatively high level of inward FDI, characteristic of an emerging economy with sustained investment attractiveness.

This behavior may reflect structural factors that drive long-term capital allocation, such as macroeconomic stability, return expectations, and Romania's integration into global value chains.

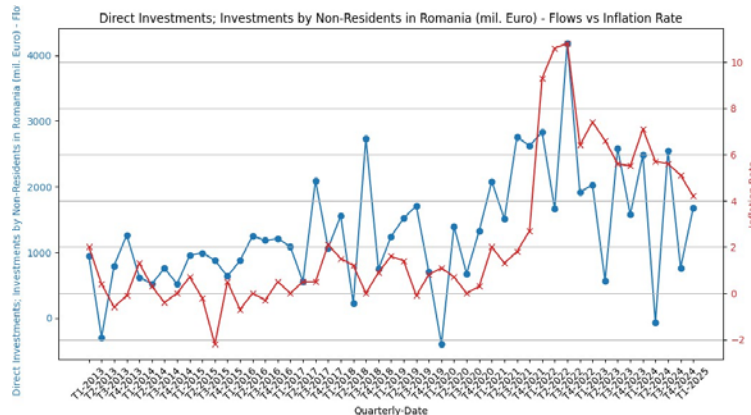
This series (Figure no. 2) shows a relatively more stable upward pattern, despite some fluctuations. There is a visible increase over time in investment magnitudes: from early values around 500–900 million EUR to recent peaks surpassing 2,000 million EUR and even 4,000 million EUR. This indicates a growing interest and confidence from foreign investors in Romania's economy. The occasional downturns appear isolated, likely tied to specific economic or geopolitical events rather than long-term structural issues. Inward direct investments display a positive, growth-oriented trend, with Romania attracting increasing capital inflows over time. This reflects improving investment climate, structural reforms, or EU integration-related attractiveness.

Table no. 2. Outward FDI by Romanian Residents (million EUR, stocks) vs. Inflation Rate – Quarterly Data

Indicator	Value
Mean	1327.70
Standard Error	127.58
Median	1210.77
Standard Deviation	893.06
Sample Variance	797,564.22
Kurtosis	1.011
Skewness	0.72
Range	4573.99
Minimum	-395.88
Maximum	4178.11

Source: own work, using Microsoft Excel

Figure no. 2 Outward FDI by Romanian Residents (million EUR, stocks) vs. Inflation Rate – Quarterly Data



Source: own work, using Python

Also, in comparison with the Inward and Outward interpretation of the FDI data, there is the Inflation Rate which has experienced significant variability, oscillating between deflation (-2.2%) and high inflation (10.8%). The mean value around 2.27% is within the typical inflation target range used by many central banks, but this conceals substantial episodic fluctuations. The positive skewness indicates that episodes of high inflation are more extreme than those of deflation. The distribution does not exhibit heavy tails (kurtosis ~0.79), meaning that extreme events are present, but not overly frequent.

The inflation rate in Romania over the period Q1 2013 to Q1 2025 displays a multi-phase trajectory, shaped by domestic policies, external shocks, and structural adjustments in the economy. During the Q1-2013 and Q4-2016 it was a deflationary period, the inflation rate fluctuated between positive but low values and several quarters of deflation, reaching a low of -2.2%. Between Q1-2017 and Q4-2020, it was a stable inflation phase, with values stabilizing between 0.8% and 2.7%. From 2021 onward, Romania experienced a sharp acceleration in inflation, peaking at 10.8%, before gradually declining to around 4–6%. The inflation surge coincided with post-pandemic global supply shocks, energy price volatility, and the geopolitical impact of the war in Ukraine.

During the first phase, despite price instability, Romania remained attractive for FDI, likely due to structural reforms, labor cost advantages, and EU integration momentum. In the second phase, FDI Inward recorded moderate to high levels, with values frequently exceeding 1.2–1.5 billion EUR. FDI Outward was more stable, lower negative values, and even some positive flows. Predictable inflation and macroeconomic stability likely increased foreign investor confidence. In the period between 2021 and 2025 FDI Inward reached historical highs despite inflation, but FDI Outward

turned sharply negative, signaling capital withdrawal or reinvestment reduction abroad. Surprisingly, FDI inflows remained strong despite inflation. High inflation may have discouraged outward FDI, as domestic firms faced cost pressures and uncertainty.

Stationarity Analysis and VAR Model Estimation

To assess the stationarity of the variables used in the analysis, the Augmented Dickey-Fuller (ADF) test was applied to each time series. The results, presented in Annex no. 1, indicate the presence or absence of unit roots and it is utile for determining the appropriate econometric modeling strategy. The tests were conducted at conventional significance levels.

The ADF test results indicate that the majority of the series under investigation – namely, the stock values of inward and outward Foreign Direct Investment (FDI), as well as the inflation rate – are non-stationary in levels and do not reject the null hypothesis of a unit root. Moreover, only one variable (FDI outward flows) is stationary in levels, while the others remain non-stationary.

Given this mixed order of integration and the absence of two or more integrated series of the same order that could exhibit a stable long-term relationship, cointegration analysis is not appropriate.

In order to stationarize the series, we performed the ADF on the 1st difference – L1 (Annex no.2).

As a result, the appropriate modelling approach is the Vector Autoregression (VAR) model in levels or in first differences, depending on the stationarity of each series (Geamănu, 2014). The VAR framework is suitable for capturing short-term dynamic interactions among the variables without imposing a long-term equilibrium relationship that is unsupported by the data.

Thus, a VAR model will be employed to explore the interdependencies between FDI flows and inflation, acknowledging their short-run dynamics while avoiding the methodological limitations imposed by the lack of cointegration.

The optimal lag length for the Vector Autoregression (VAR) model is determined using multiple criteria: Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), Final Prediction Error (FPE), and Hannan-Quinn Information Criterion (HQIC). These criteria balance model fit and complexity, penalizing for the number of parameters to avoid overfitting. The lag order that minimizes AIC, BIC, FPE, and HQIC is 7 (*), suggesting that a VAR (7) model is optimal for the dataset. The log likelihood value of -1000.72 and the low determinant of the estimated covariance matrix (Det(Ω_{mle})) indicate the model explains the data variability reasonably well.

Table no. 3. Optimal Lag Length Selection for VAR Model

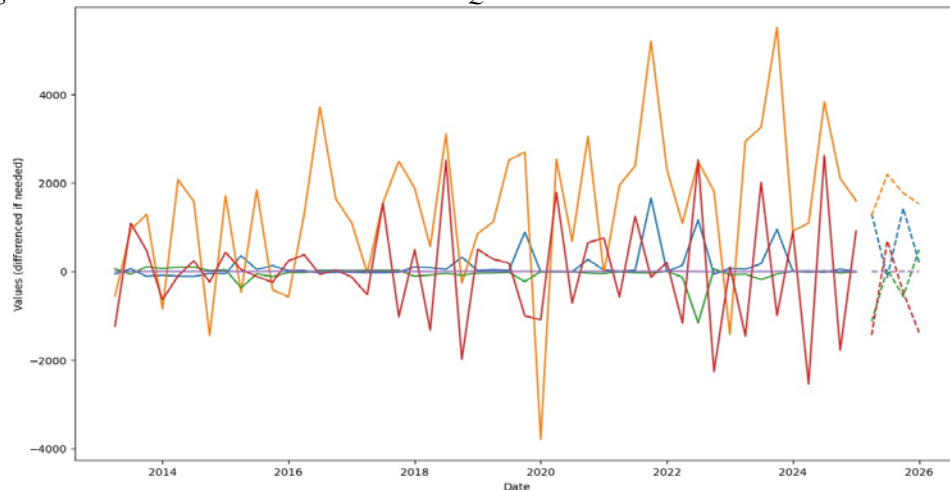
VAR Order Selection (* highlights the minimums)				
AIC	BIC	FPE	HQIC	
0	51.57	51.78	2.505e+22	51.65
1	50.45	51.70	8.179e+21	50.90
2	49.99	52.29	5.492e+21	50.83
3	49.77	53.12	5.146e+21	50.99
4	50.10	54.49	9.811e+21	51.70
5	49.16	54.60	7.024e+21	51.14
6	46.95	53.43	2.467e+21	49.31
7	43.41*	50.93*	9.454e+20*	46.15*
Summary of Regression Results Model: VAR				
Method: OLS				
Date: Sun, 01, Jun, 2025				
Time: 14:46:30				
No. of Equations:	5.00000	BIC:	50.9298	
Nobs:	41.0000	HQIC:	46.1463	
Log likelihood:	-1000.72	FPE:	9.45417e+20	
AIC:	43.4068	Det(Ω_{mle}):	4.04659e+19	

Source: Own processing using Python

The regression results for the inflation rate equation in the VAR (7) model (Annex no. 3) provide insight into the dynamic relationships between inflation and different types of foreign direct investments (FDI), both stocks and flows, of residents abroad and non-residents in Romania. The results show that both inward and outward FDI stocks and flows influence inflation with varying signs and lag structures, implying complex interactions between capital movements and domestic price levels. The mixed positive and negative lagged effects suggest inflation responds not only immediately but also with delays to changes in foreign investment. The relatively weak significance of lagged inflation itself may point to inflation being driven more by external capital movements than by its own past values within this time frame.

The short-term forecast graph (Figure no. 3, covering four quarters) provides insights into the anticipated behavior of the analyzed variables. A tendency toward inflation stabilization is observed, along with a relatively steady dynamic of FDI, without extreme fluctuations. This behavior supports the hypothesis that, although short-term relationships between inflation and FDI exist, they do not indicate major imbalances in the near future. Overall, the results confirm the VAR model's ability to capture relevant economic interdependencies without revealing systematic errors.

Figure no. 3 VAR Model – Historical Data and 4 Quarter Forecast



Source: Own processing using Python

To validate the estimated VAR (7) model, we conducted several diagnostic tests focusing on the inflation rate equation. First, the Ljung-Box test was applied to assess the presence of autocorrelation in the residuals. The null hypothesis of this test is that residuals are not autocorrelated. For the inflation rate, the Ljung-Box Q-statistic was 79.12 with a $p\_value = 0.244 > 0.05$, which means the null hypothesis cannot be rejected. This result suggests that the model does not leave significant autocorrelation in the residuals, thereby supporting its adequacy in capturing the data's dynamics (Table no. 4).

Table no. 4. Ljung-Box Test Results for Residual Autocorrelation – Inflation Rate Equation

Variable	Inflation Rate
lb stat	lb pvalue
79.121225	0.244069

Source: Own processing using Python

Additionally, the Jarque-Bera test was used to evaluate the normality of residuals. For the inflation rate equation, the JB statistic was 1.423 with a $p\_value = 0.491$, indicating that the residuals follow a normal distribution. This supports the statistical reliability of the model, particularly in terms of the error structure (Table no. 5).

Table no. 5. Jarque-Bera Test Results for Residual Normality – Inflation Rate Equation

Jarque-Bera test for normality of residuals
Variable: Inflation Rate - JB Statistic: 1.423, p-value: 0.491
Source: Own processing using Python

This result, alongside the absence of autocorrelation confirmed by the Ljung-Box test, suggests that the model satisfies key assumptions of classical linear regression, the estimated parameters and inferential statistics can be considered robust and reliable.

The results of the multivariate time series analysis indicate that the estimated model is statistically valid and captures significant short-term dynamics between foreign direct investment variables and the inflation rate. Diagnostic tests support the model's adequacy: the Ljung-Box Q-statistics show no significant autocorrelation in the residuals ($p\_values > 0.05$), and the Jarque-Bera test confirms the normality of residuals for all equations, including that of the inflation rate. Furthermore, the equation for the inflation rate reveals that several lags of outward FDI (both stock and flow components) exhibit strong statistical significance, suggesting a meaningful relationship with inflation.

Based on the results of the VAR (7) model, as well as the applied diagnostic tests (Ljung-Box, Jarque-Bera), the following conclusions can be drawn regarding the proposed research questions and hypotheses.

RQ1: *What is the short-term relationship between inward foreign direct investment in Romania and the inflation rate?*

The VAR model indicates the existence of a short-term relationship between inward FDI and the inflation rate. However, the observed effects are moderate and appear only at certain lags. This suggests that while inward FDI contributes to inflation dynamics, it is not a consistently dominant driver during the analyzed period. This leads to the partial confirmation of *Hypothesis #H1* – certain components of inward FDI show influence on inflation; however, these effects are not consistent across all analyzed lags, suggesting a weaker relationship compared to that observed for outward FDI.

RQ2: *To what extent do outward investments made by Romanian residents influence the short-term evolution of inflation?*

Variables associated with outward FDI, both stocks and flows, exhibit statistically significant coefficients at several lag intervals. Thus, outward investments made by Romanian residents appear to have a relevant and measurable impact on inflation, especially under conditions of internal economic pressure and global volatility which confirms *Hypothesis #H2*. Multiple lagged terms of outward FDI variables (both stock and flow) are statistically significant, demonstrating a clear and consistent relationship with inflation dynamics.

5. Conclusions

The overall analysis combining descriptive statistics and multivariate time series modeling reveals a nuanced relationship between foreign direct investment (FDI) components and the inflation rate in Romania. Descriptive statistics indicate a higher average level and variability of inward FDI compared to outward FDI, suggesting Romania's predominant role as a host rather than a source of foreign investments. The inflation rate displays moderate volatility, consistent with macroeconomic conditions over the observed period. The VAR model captures significant short-term effects, particularly from outward FDI both in stock and flow form on the inflation rate, with several lags being statistically significant. Diagnostic checks confirm the model's internal validity: residuals are normally distributed, and there is no evidence of serial correlation, supporting the model's reliability in explaining short-run dynamics. Overall, the findings emphasize the importance of both inward and outward investment patterns in influencing inflation and highlight the need for careful model stabilization in future research.

From a policy perspective, these findings underscore the need to monitor both inward and outward FDI when designing inflation-targeting frameworks and capital flow management strategies. The central bank should incorporate external investment trends into its forecasting models, as capital mobility especially outward FDI can act as a non-negligible driver of short-term inflation volatility.

Furthermore, promoting stable and productivity-enhancing FDI, while mitigating speculative or destabilizing flows, should be a core objective of Romania's economic strategy. Future research could expand the model to include additional macroeconomic variables to improve understanding of these interdependencies in the evolving global context.

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Annex no. 1. ADF Test Results for the Stationarity of Time Series

ADF Test: **Direct Investments – Outward; Residents' Investments Abroad (mil. EUR) – stocks**

ADF Statistic: 0.9768317683789933

p-value: 0.9940153810784345

Lags Used: 0

Observations Used: 48

The series is NOT stationary (the null hypothesis cannot be rejected)

ADF Test: **Direct Investments – Inward; Non-residents' Investments in Romania (mil. EUR) – stocks**

ADF Statistic: 2.233293402071887

p-value: 0.998908800090226

Lags Used: 0

Observations Used: 48

The series is NOT stationary (the null hypothesis cannot be rejected)

ADF Test: **Direct Investments – Outward; Residents' Investments Abroad (mil. EUR) – flows**

ADF Statistic: -6.621881749400688 p-value: 6.008444445359388e-09

Lags Used: 0

Observations Used: 48

The series is stationary (the null hypothesis of unit root is rejected)

ADF Test: **Direct Investments – Inward; Non-residents' Investments in Romania (mil. EUR) – flows**

ADF Statistic: -1.5699960991160664

p-value: 0.49864561085675796

Lags Used: 3

Observations Used: 45

The series is NOT stationary (the null hypothesis cannot be rejected)

Source: Own processing using Python

ADF Test: **Inflation Rate**

ADF Statistic: -1.644505895979485

p-value: 0.4599073139664971

Lags Used: 0

Observations Used: 48

The series is NOT stationary (the null hypothesis cannot be rejected)

Annex no. 2. ADF Test Results for the Stationarity of Time Series - First-Differenced Series (L1)

ADF Test: **Direct Investments – Outward; Residents' Investments Abroad (mil. EUR) – stocks (differenced)**

ADF Statistic: -7.189534591742421 p-value: 2.5248009254263417e-10

Lags Used: 0

Observations Used: 47

The series is stationary (the null hypothesis of unit root is rejected)

ADF Test: **Direct Investments – Inward; Non-residents' Investments in Romania (mil. EUR) – stocks (differenced)**

ADF Statistic: -7.193156196935701 p-value: 2.473424949812688e-10
Lags Used: 0
Observations Used: 47
The series is stationary (the null hypothesis of unit root is rejected)

ADF Test: Direct Investments – Outward; Residents’ Investments Abroad (mil. EUR) – flows (differenced)

ADF Statistic: -5.034750865042615 p-value: 1.893433777436228e-05
Lags Used: 9
Observations Used: 38
The series is stationary (the null hypothesis of unit root is rejected)

ADF Test: Direct Investments – Inward; Non-residents’ Investments in Romania (mil. EUR) – flows (differenced)

ADF Statistic: -7.485326592647097 p-value: 4.655446177269443e-11
Lags Used: 2
Observations Used: 45
The series is stationary (the null hypothesis of unit root is rejected)

ADF Test: Inflation Rate (differenced)

ADF Statistic: -2.843339742118095
p-value: 0.052344699664437645
Lags Used: 3
Observations Used: 44
The series is NOT stationary (the null hypothesis cannot be rejected)

Annex no. 3. Output of Inflation Equation from the VAR (7) Model

Variable	Coefficient	Std. Error	t-Statistic	p-value
Constant	0.194126	0.294913	0.658	0.51
L1.Direct Investments; Investments by Residents Abroad (mil. Euro) - stocks	0.002481	0.000584	4.247	0
L1.Direct Investments; Investments by Non-residents in Romania (mil. Euro) - stocks	0.000062	0.000132	0.47	0.638
L1.Direct Investments; Investments by Residents Abroad (mil. Euro) - flows	0.006371	0.001357	4.694	0
L1.Direct Investments; Investments by Non-residents in Romania (mil. Euro) - flows	0.000733	0.000302	2.426	0.015
L1.Inflation Rate	0.516998	0.345064	1.498	0.134
L2.Direct Investments; Investments by Residents Abroad (mil. Euro) - stocks	-0.00072	0.001157	-0.62	0.535
L2.Direct Investments; Investments by Non-residents in Romania (mil. Euro) - stocks	0.000079	0.000142	0.557	0.578
L2.Direct Investments; Investments by Residents Abroad (mil. Euro) - flows	-0.00567	0.003073	-1.846	0.065
L2.Direct Investments; Investments by Non-residents in Romania (mil. Euro) - flows	0.000398	0.000466	0.853	0.394
L2.Inflation Rate	-0.5085	0.423021	-1.202	0.229
L3.Direct Investments; Investments by Residents Abroad (mil. Euro) - stocks	0.001665	0.001435	1.16	0.246
L3.Direct Investments; Investments by Non-	0.000133	0.000143	0.929	0.353

residents in Romania (mil. Euro) - stocks				
L3.Direct Investments; Investments by Residents Abroad (mil. Euro) - flows	0.006746	0.003966	1.701	0.089
L3.Direct Investments; Investments by Non-residents in Romania (mil. Euro) - flows	0.00025	0.000614	0.407	0.684
L3.Inflation Rate	-0.15441	0.181567	-0.85	0.395
L4.Direct Investments; Investments by Residents Abroad (mil. Euro) - stocks	0.000516	0.001041	0.496	0.62
L4.Direct Investments; Investments by Non-residents in Romania (mil. Euro) - stocks	-0.00052	0.000139	-3.698	0
L4.Direct Investments; Investments by Residents Abroad (mil. Euro) - flows	-0.00246	0.00272	-0.903	0.366
L4.Direct Investments; Investments by Non-residents in Romania (mil. Euro) - flows	0.000654	0.00066	0.992	0.321
L4.Inflation Rate	0.253537	0.193756	1.309	0.191
L5.Direct Investments; Investments by Residents Abroad (mil. Euro) - stocks	-0.00217	0.000874	-2.481	0.013
L5.Direct Investments; Investments by Non-residents in Romania (mil. Euro) - stocks	0.000417	0.000166	2.512	0.012
L5.Direct Investments; Investments by Residents Abroad (mil. Euro) - flows	-0.0036	0.00203	-1.771	0.076
L5.Direct Investments; Investments by Non-residents in Romania (mil. Euro) - flows	0.000354	0.000541	0.655	0.513
L5.Inflation Rate	-0.36034	0.191281	-1.884	0.06
L6.Direct Investments; Investments by Residents Abroad (mil. Euro) - stocks	0.004072	0.001597	2.549	0.011
L6.Direct Investments; Investments by Non-residents in Romania (mil. Euro) - stocks	-0.00043	0.000181	-2.359	0.018
L6.Direct Investments; Investments by Residents Abroad (mil. Euro) - flows	0.009615	0.003008	3.197	0.001
L6.Direct Investments; Investments by Non-residents in Romania (mil. Euro) - flows	0.000582	0.000469	1.241	0.215
L6.Inflation Rate	0.289183	0.23553	1.228	0.22
L7.Direct Investments; Investments by Residents Abroad (mil. Euro) - stocks	-0.00328	0.002028	-1.618	0.106
L7.Direct Investments; Investments by Non-residents in Romania (mil. Euro) - stocks	0.000044	0.000235	0.187	0.852
L7.Direct Investments; Investments by Residents Abroad (mil. Euro) - flows	-0.00623	0.004485	-1.39	0.165
L7.Direct Investments; Investments by Non-residents in Romania (mil. Euro) - flows	-8.6E-05	0.000263	-0.327	0.744
L7.Inflation Rate	0.180871	0.128896	1.403	0.161

Erasmus Plus Mobilities and the Development of Soft Skills: A Key Driver of Student Engagement in International Experiences

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Abstract

Internationalization in higher education serves as a strategic driver of development for both institutions and stakeholders. A key instrument in this process is student mobility funded by the Erasmus Plus Programme, which significantly enhances professional training and personal growth by fostering the acquisition of both hard and soft skills. This paper focuses on transversal competencies, especially soft skills, developed through participation in international study or internship mobilities. Promoting and recognizing these competencies could increase student engagement in international educational opportunities. Furthermore, the paper systematically presents a set of policies at local and national levels aimed at supporting the development of transversal skills among all students. Despite these efforts, the research concludes that the higher education system still lacks a unified methodology for the formal recognition and certification of these competencies.

Key words: Erasmus Plus, internationalization, personal growth, professional training, soft skills

J.E.L. classification: I23, J24, O15

1. Introduction

The higher education system represents one of the most important levels of education, regardless of the country or region under consideration. Its primary role is to prepare new generations for current and future jobs on the labor market. As early as the late 20th century and the beginning of the 21st century, one of the modern approaches in this sector was the prioritization of professional training, alongside the development of professional competencies (Avdeeva *et al.*, 2017). These trends can be observed in two main directions. One is the traditional approach, where teaching staff focus their activities on the student and their individual needs. On the other hand, the institutional bodies that coordinate university activities can also implement programs designed to support both students and academic staff in their training and development.

In the field of higher education, there are various opportunities designed to meet the personal and professional development needs of all stakeholders. Whether we refer to academic staff, administrative personnel, or students, each of these groups may, at some point, benefit from a form of training or upskilling. Depending on the intended impact, such opportunities can be implemented at the local, national, or international level.

When discussing opportunities at the local or national level, these may arise, among others, from universities themselves or from public authorities (e.g., the Ministry of Education and Research). At the international level, a significant opportunity for professional development for those involved in the higher education sector is offered by Erasmus Plus, the "European Union Programme in the fields of education, training, youth and sport for the 2021-2027 period" (European Commission, 2024). The advantage of such international tools for skills enhancement (e.g., Erasmus Plus scholarships) is that they are not limited to technical training (hard skills), but also contribute to the development of non-technical competences, namely soft skills.

In light of these considerations, the following section draws on specialized literature to identify the main non-technical competences that students may develop during Erasmus Plus mobilities. In the same time, it explores the motivations behind students' decisions to apply for such opportunities.

2. Literature review

2.1. Hard and Soft Skills: Conceptual Framework

In general terms, skills are defined as "the ability to perform a task well" (Rodrigues *et al.*, 2021, p. 9). Consequently, the presence or absence of the necessary skills for a given activity can be evaluated based on the outcomes of an individual's actions. According to an official European Union document, skills are further described as "the ability and capacity to carry out processes and use the existing knowledge to achieve results" (European Union, 2018). This more comprehensive definition underscores the foundational role of knowledge in the development of skills. Building upon these definitions, within the context of the labor market, competencies can be understood as "what is required of workers for performing a specific task and describes processes leading to relevant performance in particular situations" (Hurrell *et al.*, 2012, p. 165). Accordingly, employees are able to contribute effectively to the successful execution of their responsibilities, provided that their skills align with the demands of their positions. Therefore, individuals bear the responsibility for self-assessment and for undertaking tasks they are confident in mastering and completing successfully. By possessing the competencies required for their roles, employees can work more efficiently, optimizing both time and effort (Remedios, 2012). Moreover, through the acquisition of competencies and with the support of innovation, employees can make a direct contribution to enhancing the economic performance of their organizations (Hendarman and Cantner, 2018).

One category of skills possessed by every individual is hard skills. These pertain to the execution of concrete tasks and are generally based on knowledge acquired during studies at technical or higher education institutions (Lamri and Lubart, 2023). Examples of such skills include "production processes competence", "marketing competence" and "human resource management competence" (Riyanti *et al.*, 2016, p. 123). Specifically, these skills refer to certain mechanisms, procedures, tools, or various methods that individuals are expected to follow or apply precisely (Azim *et al.*, 2010).

The second category of skills analyzed in this study, which is of particular interest, comprises soft skills. Commonly referred to as "non-technical skills", they can be defined as "non-technical and not reliant on abstract reasoning, involving interpersonal and intrapersonal abilities to facilitate mastered performance in particular contexts" (Hurrell *et al.*, 2012, p. 162). These skills can be considered a support mechanism for the previously described competencies, enabling organizations to fully leverage the technical expertise of their employees (Wesley *et al.*, 2017). Non-technical competencies simultaneously provide added value to both organizations and individuals (Mohammed *et al.*, 2024). Conversely, their absence may limit professional progress (Costantino and Rodzinka, 2022). According to a study, among the most sought-after non-technical competencies are critical thinking, creativity, and complex problem-solving (Costantino and Rodzinka, 2022). To better understand their impact, these skills can be divided into two categories. The first refers to interpersonal skills, emphasizing how a person interacts and communicates with others, while the second group pertains to intrapersonal skills, focusing on self-management and personal regulation (Laker and Powell, 2011). Examples include "self-confidence"; "discipline"; "independence"; "cooperation"; "honesty"; "fair"; "creative and innovative"; "never give up" (Riyanti *et al.*, 2016, pp. 123-124).

2.2. The Erasmus Plus Programme in the context of Higher Education sector

One of the major challenges in the field of skills development is their potential degradation, which stems from the lack of a systematic effort to continuously enhance and adapt them to the dynamics of everyday change (Costantino and Rodzinka, 2022). A key actor capable of addressing this issue is the higher education system. By its very structure, it has the capacity to support the strengthening and adjustment of both hard and soft skills among students. These two categories of competencies can be developed through standard academic activities, such as lectures, seminars, or laboratory work, as well as through extracurricular engagement. The latter may include, among others, the following types of initiatives: organizing and participating in conferences, workshops, business incubators, or competitions; engaging in volunteer work; and taking part in international study or traineeship mobilities.

International mobilities, the latter initiatives mentioned, are most frequently accessed through the Erasmus Plus Programme. Currently, no fewer than 33 countries are involved in such international exchanges, of which 27 are European Union Member States, and six are third countries associated with the programme: North Macedonia, Iceland, Norway, Serbia, Liechtenstein, and Türkiye (European Commission, 2024). Additionally, there are other third countries not associated with the programme, whose participation is subject to specific regulatory conditions (European Commission, 2024).

This programme targets a wide range of sectors, including: higher education, school education, vocational education and training, adult education, youth, and sport (European Commission, 2024). In the field of Higher Education, according to preliminary data, between 2014 and 2024, more than 4,192,000 individuals participated in an Erasmus Plus mobility in European Union Member States or in third countries associated with the programme, whether students, academic staff, or administrative personnel (European Commission, 2025). Moreover, according to the same source, over 61,880 projects were funded in the Higher Education sector through the Erasmus Plus Programme during the same period, with a total budget exceeding EUR 15.5 billion and involving approximately 101,290 organisations (European Commission, 2025).

Through the opportunities it offers, the Erasmus Plus Programme enables students to undertake, for a limited period, academic activities abroad at various partner higher education institutions or internships within organisations active in the labour market, regardless of their profile, such as enterprises, research institutes, laboratories, NGOs, or other relevant workplaces (European Commission, 2024). These scholarships support participants in developing both major categories of skills, hard and soft, thus preparing them for integration into the labour market upon graduation.

2.3. The Erasmus Plus Programme and the development of students' soft skills

Individual students may be motivated by distinct factors when deciding to apply for an Erasmus Plus mobility. For example, a study conducted by a Portuguese university identifies several key motivations, including "achieving distinction from national peers", "meeting the requirements of national employers", "enhancing the possibility of an international career", and "developing career-oriented skills" (Soares and Mosquera, 2019). These motivations highlight the importance attributed to enhancing students' employability following the completion of their mobility experiences. Furthermore, these drivers also reflect students' aspirations to secure employment within an international professional context.

Another study, conducted among students at a Romanian university, highlights a series of factors that influenced the decision to participate in an international mobility program or could motivate students who have not yet benefited from such an opportunity. Among the key determinants are: "aspiration to study in an international language", "opportunity for personal and professional development", "enhancement of career opportunities", "improvement of language skills", "gaining cultural experience", "experience living in a foreign country", and "desire to step out of the comfort zone" (Drugă, 2024). These motivations underscore students' desire to develop both hard and soft skills through international scholarships. Thus, the impact of the Erasmus Plus program can be recognized, as it combines these two dimensions through the opportunities it offers.

Considering the aforementioned aspects, it is essential to also address the soft skills that can be developed through international student exchanges, alongside technical skills. An international mobility program is regarded as high-quality due to its added value, namely its contribution to the development of non-technical skills (Confalonieri *et al.*, 2016). Therefore, the following paragraphs will present some of the soft skills that can be enhanced as a result of Erasmus Plus experiences.

According to Soares and Mosquera (2019), students can develop a range of essential competencies through participation in such programs, including 'career-orientation skills', 'adaptability skills', 'managerial skills', 'personal skills', and 'teamwork skills'. Once abroad, students are required to adapt to a new personal and academic environment, collaborate with peers from diverse cultural backgrounds, independently manage the planning of various activities, and, importantly, focus on academic tasks that broaden their horizons for future career opportunities.

According to a study conducted by Nada and Legutko (2022), the following elements were identified as transformative factors for students participating in Erasmus Plus experiences: 'self-confidence', 'independence', 'discipline', 'spontaneity', 'courage', 'adaptability', 'self-efficacy', 'openness', 'Europeanness', and 'communication skills'. Following such mobility experiences, beneficiaries often become more willing to apply again or to pursue other challenges they had previously overlooked. Moreover, an Erasmus Plus scholarship can foster a sense of belonging to the European community, alongside a desire to understand and promote its values in the future.

Another study highlights the advantages reported by students who have participated in international mobility programs. These include: 'acquisition of independent living skills'; 'acquisition of valuable future work skills'; 'cultural understanding'; 'English language skills progression'; 'easy adaptation to new environments'; 'global perspective development'; 'growth in maturity and confidence'; 'improved critical thinking abilities'; 'integration into a multicultural environment'; 'international network building'; 'preparedness to become a global citizen'; 'self-evaluation and self-improvement'; and 'teamwork skills enhancement' (Diem *et al.*, 2023). These strengths increase graduates' chances of securing employment suited to their qualifications. Furthermore, the reported benefits demonstrate that such mobility experiences have a positive impact on the personal development of the participants.

Last but not least, some authors have highlighted a range of entrepreneurial skills, often classified within the non-technical competences, that students develop through participation in Erasmus Plus mobility programs. These include: 'creativity'; 'opportunity identification'; 'ideas capitalization'; 'self-awareness'; 'motivation'; 'teamwork'; 'financial literacy'; 'initiative taking'; 'dealing with uncertainty'; 'perseverance'; and 'learning from experiences' (Grosu *et al.*, 2024). The acquisition of these skills through international experiences not only contributes to increased employability but also fosters students' interest in starting their own businesses or utilizing financial tools for saving and investment.

The existence and promotion of such a framework of non-technical skills could positively influence prospective students to apply for Erasmus Plus mobility opportunities. Additionally, it may enhance the business community's interest in recruiting students who have benefited from international scholarships during their studies. Consequently, beneficiaries may gain a competitive advantage over other candidates for available positions within companies.

3. Research methodology

Observing the diverse range of skills that can be acquired through Erasmus Plus experiences dedicated to students, the need arises for higher education institutions to recognize and certify these competencies. This is important because the skills mentioned in the previous section significantly contribute to the personal and professional development of mobility participants.

Furthermore, considering that students' socio-economic situations vary notably from one individual to another, universities should also focus their strategies on developing and promoting educational policies, adapted at the local or national level, to support the development of transversal skills.

In this context, the aim of this research is to identify and present a set of actions that higher education institutions can implement to support the development and recognition of non-technical competencies acquired by students through curricular and extracurricular activities during their university studies. Additionally, the research seeks to determine the key actors (departments; structures) involved in this process.

To achieve these objectives, a qualitative approach will be employed, based on an analysis of relevant specialized literature, with the goal of identifying the most effective solutions and courses of action. The findings of this investigation will be presented in the following section in a structured manner.

4. Findings

Irrespective of the country under consideration, the economic system plays a pivotal role and demands a workforce that is adequately prepared to ensure the efficiency and productivity of professional activities. Success in workplace performance depends on both technical and non-technical competencies (Lamri and Lubart, 2023). Consequently, recruitment authorities should implement evaluation strategies that comprehensively assess these dual skill sets during the personnel selection process. The adoption of such policies has the potential to enhance competitiveness among firms, thereby ultimately benefiting consumers through improved quality of goods and services.

Considering the aforementioned aspects, higher education institutions play a crucial role in the development of competencies. Through the education and training of students, companies can benefit from a workforce that is not only quantitatively sufficient but also qualitatively skilled. It is well recognized that the economic development of each country relies on key pillars, such as its youth (Veličković *et al.*, 2023). Moreover, in the current context, where Artificial Intelligence is rapidly advancing, it is assumed that members of Generation Z, who possess a high level of digital literacy (Giray, 2022), will adopt new technologies more quickly and easily in their professional activities (Andrei *et al.*, 2024). Therefore, it is advisable for universities to offer study programs and opportunities that are increasingly attractive, encouraging students to engage with them proactively.

Nevertheless, a series of challenges may arise that could hinder such a process. These range from technological developments, which for some academic staff represent a test of their capabilities, to the low number of individuals in each country who are eligible and willing to pursue an undergraduate program. Universities may therefore face at least two unfavorable scenarios: either the human resources are inadequately prepared, or the number of students is insufficient for the university to operate effectively. Consequently, two additional critical issues confronting the higher education system may be exacerbated: ensuring the quality of the educational process and the development of relevant competencies among graduates to facilitate their integration into the labor market (Gheorghiu *et al.*, 2021). Beyond these challenges, there are broader events that humanity has faced in recent times, such as various economic crises, the COVID-19 pandemic, and the war between Russia and Ukraine, among others. Given these contexts, the survival of higher education institutions may prove to be a complex mission.

However, one potential solution to address this unfavorable situation is the process of internationalization. This represents one of the most important policies that universities should adopt to ensure their effective functioning. By developing and implementing robust internationalization strategies, stakeholders in this sector can contribute to strengthening the educational process, facilitating cultural interaction, fostering global academic networks, and, not least, preparing students for integration into a globalized society (Duhnea and Moraru, 2025).

The instrument through which these objectives can be achieved is represented by international student mobility (Doda *et al.*, 2024). Despite existing challenges, students increasingly demonstrate interest in international experiences in various forms (Duhnea and Moraru, 2024). However, to be attractive, universities should enhance their institutional image by implementing measures that consider the following aspects: academic reputation; ranking positions in international league tables; language programs; connections with various industries; career development opportunities for students; and financial incentives or scholarships (Gutema *et al.*, 2024).

Recognizing the importance of non-technical skills in the development of local economies, alongside the promotion of international mobility, universities should adopt programs that support the development of these competencies among students (Bardales-Cárdenas *et al.*, 2024). Such initiatives could also be implemented at the national level, thereby avoiding the emergence of language barriers. Participation in these sessions would contribute to students' personal development while simultaneously enhancing their employment prospects compared to peers who do not benefit from such programs (John, 2009). Moreover, through the integration of policies of this nature, the evolving role of higher education institutions in fostering entrepreneurship and innovation among students becomes increasingly evident (Jurgelevičius and Raišienė, 2024).

Thus, in addition to their traditional missions of teaching and research, universities, by contributing to economic development through innovation and knowledge transfer, will further establish themselves as entrepreneurial institutions (Tripa *et al.*, 2025).

These represent several formal methods that national authorities, together with higher education institutions, can implement. One informal approach that could be proposed is the organization of extracurricular events within student dormitories. These environments serve as true learning and living communities (Confalonieri *et al.*, 2016). In such settings, student groups may experience less pressure from academic staff. By providing the ideal framework for experiential learning, students can practice and develop various non-technical skills, such as adaptability, creativity, communication, responsibility, empathy, among others.

Last but not least, Career Counseling and Guidance Centers within universities can play a crucial role in leveraging soft skills. By participating in mentoring and counseling sessions organized by these centers, students can be supported in identifying a professional path that aligns not only with their vocational profile and the technical skills acquired during their academic studies but also with the transversal skills developed throughout their educational journey. This approach significantly reduces the risk of graduates investing time and resources in unsuitable positions that do not reflect their true level of preparation or professional aspirations. These situations could have led to demotivation, job instability, and, in some cases, frequent career reorientation during the early years of employment. Considering that, procedurally, there is no common framework through which higher education institutions formally recognize these competencies to support graduates' employability (Cinque, 2016), participation in career counseling and guidance activities may constitute a viable alternative to facilitate appropriate professional integration.

5. Conclusions

This paper highlights that, through the tools at their disposal, higher education institutions can make a significant contribution to the development of both students' technical and non-technical skills. Depending on the level of interest and engagement of universities, programs can be promoted that support the balanced development of both categories of competencies.

A strategic component in this regard is represented by the opportunities offered through the Erasmus Plus Program, which facilitates international study and internship mobility. Access to such scholarship by students contributes not only to the deepening of theoretical knowledge but also to the development of a valuable set of transversal competencies, such as adaptability, independence, teamwork, intercultural communication, spontaneity, and others.

However, despite the positive impact of these experiences, a significant challenge remains in the lack of standardized methods for recognizing and validating the non-technical skills acquired. While established evaluation systems such as grades and diplomas exist for technical competencies, similar tools for non-technical skills are still underdeveloped. Therefore, it is imperative that educational authorities and involved institutions prioritize the development of clear methodologies for identifying, measuring, and certifying these abilities.

The present paper has primarily focused on the policies that universities can adopt to promote the development of non-technical skills, particularly through international mobility programs. For future research, we intend to design and administer a questionnaire targeted at students who have benefited from Erasmus Plus mobility experiences, aiming to identify and verify the skills developed throughout these programs. Additionally, a focus group will be conducted with students who have not yet participated in such mobility programs, in order to analyze their perceptions and motivations regarding the opportunity of international mobility.

In conclusion, given the increasingly complex role of universities in preparing future generations of professionals, it is essential for these institutions to encourage student engagement in both curricular and extracurricular activities, conducted at local, national, or international levels. By integrating these complementary experiences, conditions can be created for a comprehensive education that harmonizes technical and non-technical skills, thereby contributing to the adaptability and long-term success of graduates in a globalized labor market.

6. Acknowledgement

This work was supported by the Erasmus Mobility as Micro-credential (ERASMUSNESS) project, no. 101185363, co-funded by the Erasmus Plus Programme.

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Family Well-Being in the Face of Economic Turmoil: Perspectives of Devoted Fathers as Mentors

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Abstract

This paper explores the perspectives of devoted and engaged fathers who provide emotional stability, financial guidance, closeness, spiritual strength (a core element), and moral support to their families during economic hardships. Currently, families are living in dire circumstances owing to economic turmoil, which not only presents significant challenges to their well-being but is also detrimental to their existence. In economic turmoil, resilience, shared responsibilities, collaboration, and open communication help families navigate difficulties while strengthening bonds and ensuring emotional and financial security for all. Devoted fathers view their role as vital and relevant in the current economic situation of families. They also serve as mentors and play a crucial role in fostering resilience. By examining their mentorship strategies, this research highlights how paternal involvement strengthens family cohesion, enhances children's emotional security, and mitigates financial stress, ultimately promoting a stable and nurturing home environment despite economic instability.

Key words: devoted fathers; economic turmoil; family well-being; mentoring; perspectives

J.E.L. classification: Z12, Z13

1. Introduction

Well-being and family well-being are key concepts in the context of this paper. Yaxley *et al.* (2012, pp.13-14) describe well-being as a state of good mental health characterized by an individual's recognition of their strengths, proficient management of everyday stressors, effective and efficient functioning, and contribution to the community. Yaxley *et al.* (2012, pp.13-14) consistently use the word "well-being" with varying interpretations contingent upon the context. Likewise, family well-being denotes the overall health, stability, and quality of life enjoyed by the members of a family, including physical, emotional, social, and economic dimensions. It encompasses robust connections, efficient communication, financial stability, and nurturing surroundings that foster resilience, growth, and comprehensive life satisfaction within the family unit. The significance of family constitutes a connection of affection, assistance, and cohesion, influencing our lives with compassion and tenderness.

What is family in the context of this paper? A family is defined as a group of people linked by blood, marriage, or adoption, often residing together and having emotional and financial bonds. Kath (2021, p.15) states that the term "family" originates from the Latin word *familia*, denoting "household" or "household servant," and from *famulus*, which translates to "servant." The term "family" refers to a distinct social group whose primary function is to offer nurturing care for the development of all its members (Kane, 2019, pp.65-67). It serves as the principal institution for personal growth, support, and protection (Saikia, 2017, pp.445).

The family's well-being is of the utmost significance. The family unit is esteemed in society, with the presence and accessibility of both parents being essential in children's lives. The absence of one parent creates a hole, complicating the attainment of familial harmony and happiness, which are vital for familial well-being and conflict mitigation. Barnard (2018, p.6) asserts that the integration of

family well-being within an ecological framework allows families to prosper despite numerous hurdles.

Prioritizing one's well-being amplifies one's ability to support others and contribute constructively to society in the face of economic and personal obstacles. Investing in well-being is a lifetime pursuit that promotes vitality, longevity, and deep contentment, allowing individuals to lead richer and more meaningful lives (Koen *et al.*, 2012). Family well-being is a crucial element that underscores the general health and unity of family groups, recognizing that families profoundly influence individual well-being. A family thrives when its members participate in emotional bonding, efficient communication, and mutual support. It involves creating a safe and nurturing environment where each member feels esteemed and recognized. This dynamic includes the satisfaction of essential requirements such as shelter and food, as well as the development of trust, affection, and communal happiness.

Strong familial bonds cultivate resilience, allowing individuals to navigate stress and misfortune through collective strength and comprehension. Fundamental factors affecting family well-being are stability, clear communication, shared responsibility, and significant time spent together. Financial stability, educational access, and health care are essential for creating the foundation required for families to prosper. Emotional intelligence in the family is essential, promoting conflict resolution and nurturing empathy. External variables, such as economic difficulties, community assistance, and societal policies, can affect family well-being. Access to family-oriented workplaces, mental health resources, and inclusive social institutions can significantly enhance the overall quality of life of families. The well-being of families is fundamentally connected to the entire well-being of society, underscoring the need to cultivate strong, supportive, and healthy family dynamics for the prosperity of people and communities (Koen *et al.*, 2012).

2. Theoretical background

The literature review of this paper comprises a metatheoretical examination of family well-being, the fluctuating economy, and devoted fathers as mentors.

2.1 Social issues and economic difficulties pose challenges to the implementation of family well-being

The primary social issues and economic difficulties confronting the youth in South Africa and globally include violence, gang rape, rave parties characterized by the unrestricted availability of drugs and sexual activities, social challenges, and a pervasive lack of mutual respect and regard for the environment (Carstens & Zwecker, 2013, p.2; Oladepo & Fayemi, 2011, p.8; Otto, 2013, p.4). Currently, parents experience significant challenges with the conduct and values of children both at home and in educational settings (Freeks, 2013, pp.11-12; White & Warfa, 2011, pp.45-48). It is widely believed that children and young people are incapable of making sound and effective value judgments, necessitating education, mentoring, and guidance to facilitate their decision-making (Georgiades *et al.*, 2013, pp.1473-1476; Logan-Greene *et al.*, 2012 pp.373-374).

The proximity of family residence correlates negatively with the likelihood of youngsters engaging in aggression and hazardous behaviors, including bullying. The prevalence of violence among children in educational institutions and domestic environments is emerging as a significant issue, prompting many to scrutinize the role of parents as main carers in fostering self-respect in their children. Young people with self-respect will demonstrate respect for the time, property, relationships, work, animals, friends, and family of others, refraining from "stealing" time at school through class disruptions, conflict with peers, inappropriate language, or other unacceptable behaviors (Pretorius, 2006, p.3). Llale (2003, p.3) asserts, "The manner in which you nurture your children unequivocally influences the trajectory of their future." Many of these issues and circumstances are attributed to the absence of fathers (Freeks, 2013, p.3; 2011, p.4). Reddick *et al.* (2011, pp.1-3) and Hazen *et al.* (2010, pp.51-55) assert that the lack of paternal presence results in ineffective father-child connections. Research conducted by Mandara *et al.* (2005, pp.207-220) and Steytler (2007, p.37) revealed that boys raised without a father are more susceptible to engaging in criminal behavior. The role of the father is sometimes assumed by surrogate fathers. In African rural

societies, for example, it is common for an older brother to assume the role of the missing or deceased father. This substitution engenders significant issues, including erroneous identification and inaccurate values (Olsen, 2007, pp.174-196).

The family, especially when the father serves as a mentor, ought to assume a much larger role in instilling values, as values have diminished in societal prominence (Schaps, 2005, p.1). From this perspective, mentors and mentoring pertain to connections; they unlock individuals' potential and enable them to achieve their utmost capabilities. This educational connection involves a mentor who imparts information, experience, and insights to a less experienced individual, the mentee, who is prepared to gain from this exchange (Tucker, 2007, pp.iii, vi). Despite the complexity of mentoring relationships, it is essential to recognize that their foundation is in daily encounters that facilitate growth and development (Wood & Duck, 2006, p.156). Children benefit significantly from paternal involvement and the demonstration of values by their fathers (Freeks, 2013, pp.75-77; Vogel *et al.*, 2006, pp.189-209). Fathers should not just fulfill the role of financial providers. Children require their fathers' presence in their lives to engage in meaningful interactions (Williams, 2008, p.18). The father's worth should be assessed based on material or financial contributions, alongside the affection and care he provides to his family and the standards he establishes for values.

Boys view their fathers as role models who exemplify principles via their actions. Eventually, they will assume their parenting responsibilities independently (Goeke-Morey & Cummings, 2007, pp.221-225). Most children appear hesitant and perplexed, seeking their fathers' affiliation, presence, and lifestyle embodying positive values, as they need identification and a foundation of certainty (Ford *et al.*, 2008, pp.284-299). The aforementioned indicates a challenge stemming from the absence of the father. Hence, father absence exacerbates such issues. As a parent, it is essential to serve as a mentor within the household. The inquiry that emerges from the discourse is how devoted fathers perceive their responsibility as mentors to ensure family well-being in economic turmoil.

2.2 The historical notion of mentoring

The genesis of mentoring and the notion of a "mentor" can be elucidated via the lens of Greek mythology. Odysseus was a Greek warrior who participated in the Trojan War and entrusted his son to a confidant named Mentor. The war continued for a decade, and Odysseus required another decade to make his way home. Upon Odysseus's return, he saw that his son, Telemachus, had reached maturity and developed commendable morals, mostly thanks to Mentor's influence. This interpretation posits that a mentor exerts an immediate or direct influence on an individual's life; consequently, the concept of mentoring has garnered attention and evolved over time (Fourie & Van den Berg, 2007, pp.94-95; Freeks, 2013, p.32; Hendricks & Hendricks, 1995, pp.17-18; Steytler, 2007, p.12).

The notion and implementation of mentoring have been expanding both outside and within ecclesiastical contexts and leadership (Lewis, 2009). Lotter (2010, p.6) emphasizes the increasing significance of mentoring across various contexts, including the business sector, religious institutions, higher education, and diverse training modalities, spanning from commonplace to highly advanced forms of mentoring. What does the term "mentoring" signify within the scope of this paper? Mentoring is a reciprocal process in which the mentor (leader) and the mentee (follower) cultivate mutual understanding, establishing a relationship in which the mentor dedicates time to assist the mentee in achieving their potential (Freeks, 2023, pp.2-3). Mentoring necessitates the mentee's willingness and preparedness to actively participate in a learning relationship of dynamic interaction, entailing an exchange of learning, experience, information, and insights from which the mentee should gain significant advantages (Tucker, 2007, pp.iii-vi). Mentoring involves providing support and encouragement to individuals, enabling them to take charge of their learning, thereby maximizing their potential, enhancing their abilities, improving their performance, and evolving into their desired selves (MentorSET, 2008). The mentor serves as a guide, assisting the mentee in identifying the appropriate course. Mentors possess empathy for the mentee and comprehend their challenges. Furthermore, they instill self-belief in their mentees and enhance their confidence (MentorSET, 2008; Santora *et al.*, 2013, pp.427-428).

The prospective mentor is eager and driven to assist the mentee, as the mentor enables the mentee to recognize their potential through guidance, motivation, inspiration, and support, thereby facilitating the mentee's attainment of their life goals. Freeks (2011, pp.53-54), Pue (2008, pp.16-18), and Lotter (2010, p.6) list the following activities in which mentors often engage:

- They assist individuals in acquiring the fundamentals of living with Christ (disciple).
- They help individuals achieve deeper maturity in their Christian life (spiritual guide).
- They assist individuals in acquiring skills (coach).
- They assist individuals by providing prudent advice to navigate challenging circumstances (counselor).
- They facilitate the acquisition of fundamental concepts and views (teacher).

In short, mentoring is a helpful, educational connection in which a mentor imparts information, experience, and insights to a less experienced individual. Consequently, it requires time and perseverance, as Pue (2008, p.13) rightly points out about the process of mentoring disciples and cultivating leaders, which can be seen as equivalent endeavors.

2.3 Devoted fathers: the heart of strong families

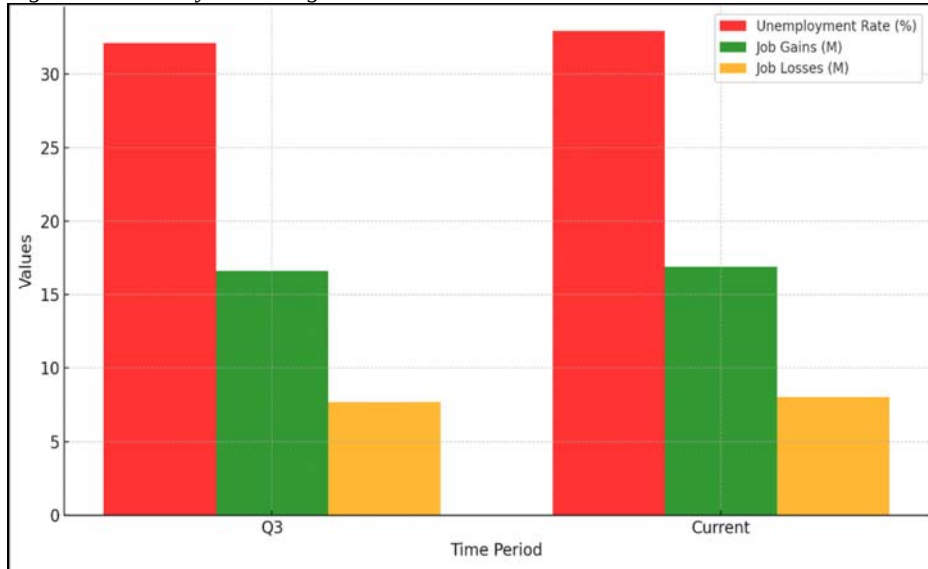
The author strongly believes that devoted fathers are pivotal in developing robust, resilient families and promoting family well-being (Frees, 2024, pp.319-321). Their unwavering presence, emotional support, and active engagement foster a sense of security and belonging that children retain throughout adulthood. A present father fosters his child's development and fortifies familial connections via affection, guidance, and collective responsibility. A positive relationship between fathers and their children increases the chance that these fathers will maintain an influential relationship and a connection with their children (Powell *et al.*, 2021, p.549).

Research indicates that children with involved and devoted fathers are more likely to achieve academic success, cultivate good relationships, and have sufficient confidence (Dunn & Maharaj, 2023, p.2133; Pfizner *et al.*, 2017, p.538). Devoted fathers exemplify respect, discipline, and compassion, establishing a formidable standard for the entire family. Their dedication fosters equilibrium and resilience, assisting families in confronting economic turmoil and adversities with solidarity and fortitude. In a society where time is frequently constrained, a father's deliberate endeavors to listen, guide, and nurture are the core of a flourishing household. In essence, devoted fathers not only support families but also contribute to their construction and maintenance (Alissa *et al.*, 2017, pp.191-193).

2.4 Family well-being in the face of economic turmoil

Economic turmoil profoundly affects family well-being, resulting in heightened financial strain, mental health issues, and alterations in family dynamics. In South Africa, increasing unemployment rates and wealth disparity intensify these challenges, leading to increased instances of depression and anxiety among people and families. The official unemployment rate in South Africa is 32.1% for the third quarter of 2024—a reduction from 33.5% in the preceding quarter. Financial limitations have had an impact on family planning choices worldwide, leading numerous millennials to prefer smaller families owing to the escalating expenses associated with housing, health care, and day care. Confronting these difficulties necessitates holistic tactics, including enhancing financial literacy, broadening access to mental health care, and enacting laws that bolster economic stability and familial welfare. Indicators of family well-being amid economic turmoil are presented in Figure 1.

Figure no. 1 Family well-being indicators amid economic turmoil.



Source: Author's own compilation from data of Stats SA, 2025

In the figure, labor market stress indicators show a rise in official unemployment (now at 32.9%) despite incremental job gains. The simultaneous increase in job losses underscores the volatility of family well-being in economic turmoil. The bar graph illustrates markers of familial well-being under economic upheaval. It juxtaposes the third quarter (Q3) with the present time by illustrating the following: the unemployment rate (shown in red) increased from 32.1% to 32.9%; job gains (in green) rose to 16.9 million; and job losses (in orange) increased to eight million (Own compilation from data of Stats SA, 2025).

Unemployment has a profound impact on family well-being in South Africa. Devoted fathers, acting as mentors and pillars of strength, demonstrate resilience by providing emotional and practical support to their families, assisting them in overcoming the challenges posed by economic turmoil.

3. Research methodology

In this study, devoted fathers employed an interpretative descriptive methodology to investigate the notion of family well-being during economic distress. Semi-structured interviews were conducted with devoted fathers. The research committee of the Faculty of Theology and the participating fathers provided informed consent for conducting the research.

The aim of this research was to examine the perspectives of devoted fathers as mentors within the framework of family well-being.

The study population comprised fathers from the Tlokwe municipal region. Black participants from Ikageng, Colored participants from Promosa, and participants from the predominantly White population in the larger Potchefstroom area of South Africa took part in the research. Purposive voluntary sampling was used (see Babbie & Mouton, 2001, pp.166-167; De Vos, 2005, p.202). A total of nine fathers participated; however, data saturation was reached after the sixth interview.

The researcher conducted interviews with the participants to see whether the acquired data met the goals of the research. The following inquiries were posed: "Describe your experience of being mentored as a child or adolescent by either your father or a paternal figure?"; "Elucidate how you, as a father, fulfilled the role of a mentor?"; "What is your perspective on the father's role in the familial well-being context?"; and "Please explain the significance of mentorship in your role as a father in a familial well-being context." The researcher fostered a rapport with the participants, cultivated a secure, non-threatening environment, and employed communication strategies to enhance the interviews. The interviews were recorded, and field notes were documented after the interviews, concentrating on personal, observational, and methodological insights.

The audio recordings were transcribed verbatim. The researcher employed Tesch's (2003, p.192) delineation of the open coding technique. The procedures undertaken included arranging and preparing the data for analysis, generating an overarching understanding of the data, categorizing the data into subcategories and themes, and providing descriptions and representations of the topics. An impartial co-coder was used, and a consensus discussion between the co-coder and the researcher concluded the analysis.

Krefting (1991, pp.215, 222) refers to the Lincoln and Guba model to validate the credibility of a study. The emphasis of this study was on truth value, application, consistency, and neutrality, in line with Botma *et al.* (2010, pp.234-235). The researcher guaranteed the validity of the findings by extensive participation during semi-structured interviews and consistently employing reflexivity through field notes and interactions with stakeholders. The use of purposive volunteer sampling and a comprehensive description of the study methodology facilitated the application. An audit record and the use of an independent co-coder throughout the data analysis guaranteed consistency. Moreover, the audit trail and reflexivity resulted in impartiality.

The researcher conducted many sessions with the participants to elucidate areas of their engagement, participation, consent, protection, and confidentiality. The right to self-determination is grounded in the ethical concept of respect for individuals; hence, the researcher regarded all the participants as autonomous agents. The participants were informed that their involvement was entirely voluntary and that they could leave the research at any moment without incurring any penalties (see Burns & Grove, 2005, p.101; Brink, 2007, p.32). All the participants were accorded with equitable treatment and dignity (see Burns & Grove, 2005, p.107).

4. Findings

The discussion of the results of the study is enriched with verbatim quotations. Ten main themes emerged from the semi-structured interviews with the devoted fathers.

Theme 1: Personal experiences of mentorship during childhood. The participating devoted fathers recounted their experiences of intimacy with their biological fathers or other paternal figures, including foster fathers and clergy. They gave the following remarks: *"We resided as a family, sharing meals and activities despite our financial limitations,"* and *"We developed a close-knit relationship, forging a strong bond amidst challenging economic conditions."*

Theme 2: Fathers establishing the foundations of the Christian faith. The participants said that their teachers were committed Christians who served God in distinct manners. For them, Christianity was a significant aspect of parenthood and imparting faith. They articulated their perspectives with statements such as *"[t]hey established the groundwork for the Christian faith, thus believing in it and perceiving a divine essence within,"* and *"[w]e were impoverished and residing in destitute communities; yet they imparted knowledge about the Bible and the principles of fatherhood."*

Theme 3: The significance of sharing and caring within the family unit. In this theme, the participants asserted that sharing and caring were essential within the family as they fostered cohesiveness among members and enhanced familial well-being. They articulated their perspectives through the following statements: *"Sharing and caring strengthen familial connections,"* *"Caring for one another is biblical, and financial resources are unnecessary for this"* and *"An individual cannot exist in isolation from others."*

Theme 4: Characteristics imparted by the mentor. The participants said that the mentor figures cultivated qualities such as humility, humor, and acceptance of others. Their remarks were as follows: *"Humility is a valuable attribute, as it facilitates the emergence of positive outcomes,"* *"Laughter should permeate the household, even amidst adversity and scarcity"* and *"Embrace the diverse viewpoints of various family members."*

Theme 5: Devoted fathers ought to provide discipline and patience as essential family virtues. The participants said that discipline and patience were essential values within the family. They advised fathers to nurture and discipline their children, administering punishment in accordance with biblical teachings. The participants articulated their perspectives as follows: *"Disciplining your child is crucial as it correlates with discipleship,"* and *"The formula for patience is diligent effort."*

Theme 6: The loving father's role as a mentor in fostering children's development to promote family well-being. Theme 6 delineates the participating fathers' anticipations as mentors in the lives of their children. Aspects discussed were children's voices, paternal affection, and the significance of discipline within the household. The devoted fathers felt that children ought to cultivate independent thought and articulate their viewpoints since they are persons in their own right. Individuals ought to possess the liberty to express themselves. The participants said, *"Children should have the liberty to express their beliefs and values among their friends and peers,"* and *"Children internalize lessons imparted by their fathers and emulate the examples set by them."*

Theme 7: The significance of mentorship. This theme illustrates the significance of mentorship, which is essential for familial well-being. Mentoring influences lives, and the participants indicated that it was essential for children: *"Through mentoring, families can cultivate a generation,"* and *"Mentoring presents an opportunity to influence children's lives with values."* Fathers bear an obligation to guide their families, and the participants underscored the necessity of remaining vigilant. Fathers must deter their children from emulating detrimental role models. The participants said, *"In the absence of a father, mentoring is lacking,"* and *"If fathers fail to mentor and guide their children, others will do so in a misguided and deceptive manner."* They also asserted that mentoring youngsters was essential to safeguard them from becoming victims of others and said, *"Mentoring is crucial for children,"* and *"If we, as parents, remain inactive, our children will suffer consequences."* Mentoring constitutes a collaborative effort in which the father, the mother, and the entire family should cooperate. The participants articulated their viewpoints as follows: *"Mentorship is not solely limited to fathers but also encompasses other parental figures,"* *"The father is not the only mentor within the family; the mother also plays a role,"* and *"Parents ought to mentor older siblings so that the extended family can serve as mentors to the younger generation."*

Theme 8: Fathers are unable to fulfill their responsibilities. Many of the participants expressed the perception that fathers experienced a decline in their effectiveness. This engenders familial issues and endangers familial well-being. The absence of fathers is the most significant issue in contemporary life; this deficiency leads to complications, including marital discord.

Theme 9: Contemporary democracy engenders challenges. The participants contended that democracy engenders issues by diminishing parental influence over their offspring. They said, *"Democracy is a malevolent force as children exhibit diminished concern,"* *"It originates from infernal sources,"* *"We refer to it as democracy rather than democracy,"* and *"Democracy has usurped numerous parental responsibilities, particularly those pertaining to familial well-being."* Democracy imposes stringent expectations on the moral integrity of individuals. Consequently, democracy would not prevail in the nation if the populace cannot exercise self-discipline.

Theme 10: Fathers ought to demonstrate commitment and dedication. The participants asserted that fathers must remain dedicated and attentive, acknowledging their responsibilities as paternal figures within the family amid the economic problems. Fathers should be fully devoted. According to the participants, a dedicated and devoted father ought to contemplate the following questions: *"What lessons am I imparting to my children to foster familial well-being?"* and *"Am I exemplifying these principles before my family?"*

5. Recommendations

The main recommendation is that devoted fathers should be empowered and informed of their mentoring responsibilities for their family's welfare throughout economic distress. This can be accomplished through seminars, conferences, workshops, men's retreats, church programs, training events, road shows, and community training initiatives. The findings of this research may facilitate the development of a model portraying devoted fathers as exemplary mentors within their families. This can assist society by raising appreciation of the position of devoted fathers as mentors in their children's lives. Motivating and encouraging mothers through similar programs and seminars may significantly benefit devoted fathers in their roles as mentors. Mentoring is a collaborative effort, in which the father, mother, and other family members should unite to enhance the efficacy of the mentoring process within the familial setting, thereby fostering overall familial well-being.

6. Conclusion

From the literature review and the findings, it can be concluded that the role of the devoted father is critical in the family context to promote family well-being. It is evident that devoted fathers feel forceful about mentoring in the family context, irrespective of economic turmoil. There is, unfortunately, a great need for devoted fathers as mentors in the family context and the broader society.

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Green Deal and the Role of Circular Economy in Reaching Climate Neutrality

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Abstract

In 2019 the European Commission has introduced a new proposal, the European Green Deal (EGD), that is meant to adapt European Union's (EU) climate, energy, transport and tax policies to ensure a reduction of net greenhouse gas emissions by at least 55% by 2030 compared with 1990 levels and reach climate neutrality by 2050. An important pillar of the Green Deal is the new circular economy action plan.

Thus, in order to monitor the role of circular economy in reaching the objective of climate neutrality, the aim of this research is to highlight the importance of circular economy to the EU's zero emission economy, considering strict requirements found in literature based on a bibliometric analysis, shedding new light on the challenges facing the EGD. The results showed that a closed loop economy is at the core of the reaching climate neutrality. The research results and directions pointed in this paper have the potential to strengthen the sustainability of the EU's decarbonisation policy.

Key words: Green Deal, circular economy, climate neutrality, sustainability, circular economy action plan

J.E.L. classification: Q56

1. Introduction

The increasing environmental impacts caused by climate change led the European Commission (EC) to propose the European Green Deal (EGD) in 2019. The EGD emphasises the need for a holistic and cross-sectoral approach, with all relevant policy areas having a role in achieving a reduction of greenhouse gas emission by 55% in 2030 compared to 1990 levels and the ambitious goal of climate neutrality by 2050.

Kurze & Lenschow (2018) and Dupont et al. (2020) have argued that EGD represents a broad and more systemic approach to the transition to sustainability than previous EU initiatives and policy developments, which have mainly focused on mainstreaming climate change mitigation in the field of energy policy. Therefore, it could be understood as a critical juncture that sets the EU on a "new, potentially transformational path" (Dupont et al., 2020).

In order to reach the 55% emission reduction target, European Commission has introduced a set of measures, through the legislative package "Fit for 55" that are aimed to reshape EU's core, including changing consumer behaviour. The main objectives are: reduction of GHG emissions, tackling energy poverty, creating jobs for the future, concentrating on green innovation and boosting sustainable growth.

Furthermore, in 2020, the European Commission adopted an important pillar of the Green Deal, the new circular economy action plan (CEAP). It is considered that EU's transition to a circular economy will reduce pressure on natural resources and will create sustainable growth and jobs. The

new action plan is comprised of initiatives along the entire life cycle of products, including how products are designed, and aims to ensure that waste is prevented.

According to Elena Cristina Rada (2023), the concept of circular economy is the opposite of what was introduced in the 19th century - linear economy- which was based on the terms: take, make, consume, throw away.

In what concerns the existing circular economy policies, Morseletto (2020) argues that, even though they are highly popular, existing targets for recovery and recycling do not necessarily promote a circular economy. He goes on to say that because of these inefficiencies, other powerful circular economy strategies that have the potential to reduce waste, close production loops and maximise retention of the economic value of materials, should be considered.

The aim of the paper is to show the role that circular economy plays in achieving the decarbonisation targets and provide meaningful insight into what measures that can be taken in order to strengthen its position. Therefore, it aims to show the contribution that circular economy has brought in terms of reducing GHG emissions and prolonging the life span of materials and products.

The proposed research comprises five sections, starting with the introduction, which presents a brief literature review of the researched subject and the objective of the study. It then continues with the authors providing more detailed information of the subject of the study and the articles which were selected, structured in the literature review. Following the literature review is the research methodology section, which presents the databases and software used, together with the process for data collection. The findings section, which discusses the methodological aspects of the bibliometric analysis and, implicitly output of the data collection process, as well as proving a conceptual structure analysis of this research topic. Lastly, the fifth section presents the conclusions of the study, its limitations and possible research directions for the future.

2. Literature review

In line with the research objective mentioned above, the literature review consists of published papers, indexed in Web of Science (WoS) that explore the relationship between circular economy measures and decarbonisation levels in the context of Green Deal policy objectives that can result into climate neutrality. Having in mind that the EGD has been recently introduced (2019), the articles which were subject to the empirical analysis have been published between 2021- 2025, with the highest density between 2022 and 2024.

Table no. 1 Review of the papers that are exploring the relationship between circular economy and climate neutrality

Authors	Research objective and main findings	Circular economy role and approach in the context of Green Deal
Cifuentes-Faura, J. (2022)	The research aims to review the main policies that have been implemented in the EU to reduce environmental problems. It also includes a review of the climate change policies and their impact. The paper also proposes solutions to be followed, such as those based on the Circular Economy. One of the solutions is teaching sustainability in educational institutions in order to make future professionals aware of the importance of protecting the environment. Furthermore, the paper proposes measures such as giving incentives to industries that meet the established GHG emission targets, in order to further promote environmental protection.	The circular economy model should be the foundation for EU policies, where sustainable consumption is encouraged and resources maintained for as long as possible. Reducing waste generation is also at the core of circular economy. Focus should be placed on solidarity when defining the principle of the European Green Deal, with collaboration between all Member States and different parts of society. Achieving climate neutrality will require collective efforts, and involving young people will lead to a change their consumption patterns and will provide sufficient information to limit their carbon footprint and live in a greener and healthier environment.

Witjes, S. and Lozano, R. (2016).	The paper aimed to contribute to circular economy by providing knowledge on the relationships between sustainable public procurement (SPP) and the development of more sustainable business models. The research has been able to prove that by incorporating sustainability criteria into their business models (Lay et al., 2009) companies are likely to fulfil SPP process specifications. However, it is argued that for this to happen closer proximity between the supplier and the procurer in the procurement process is needed.	The author provides information about the purpose of the introduction of the circular economy concept, arguing that it has been proposed to address environmental issues by transforming waste into resources, and bridging production and consumption activities. The author continues to say that a systemic multi-level change is required in order to transition to a circular economy that actually work.
Larsen, et al (2022)	The authors have conducted an analysis of forty-two articles in an effort to identify the knowledge gaps in this area of integrated life cycle thinking, encompassing Life Cycle Assessment (LCA), Life Cycle Costing (LCC), and Social Life Cycle Assessment (S-LCA) into Life Cycle Sustainability Assessment (LCSA). The aim of the research was to discover if an integrated assessment methodology, that can support the transition of the construction and real estate industry to a circular economy, has been applied. The paper found that further research in evaluating circular economy should be done and proposes the practice of integrating LCA, LCC and S-LCA into LCSA, so it can support the transition.	For circular economy, in the construction sector, to succeed in contributing significantly to climate neutrality, a comprehensive and circular view upon buildings' life cycle phases is necessary. This will have an impact the building's value chain, regarding the involvement of more stakeholders, not only in the early phases of project development (decision-making) but particularly in the design phase. Furthermore, specific focus upon making integrated life cycle sustainability assessment operational and useable for practitioners in the building processes is necessary.
Klavins, M., et al (2024)	The study proposes an assessment tool for evaluating airport strategic plans and environmental reporting to promote sustainability. The research introduced an application, Data centre Energy Sustainability Score (DESS), in order to demonstrate the use of material and social views on sustainability strategy.	In the author's opinion, the Green Deal is not only about the introduction of environmental policies and the development of innovative technological but, about changing of mindsets in societies. Furthermore, the paper aims to prove the close relationship between the transformation of the current model of consumption to reduce waste and circular economy. It Continues with the idea that in order to reach Green Deal's objectives, redesign of economies and decoupling economic growth from material consumption, carbon emissions, and waste generation is needed.
Drewnowski, J., et al. (2024)	The article proposes integrating and using a resource database for the recovery and reuse of coffee industry residues, focusing Circular Economy Model. The paper is aimed to consolidate existing knowledge coffee grind output, management, characterization, treatment, and various methods for resource recovery and recycling. The results of the paper show that research is lacking timely exchange of information. Therefore, the development of high value-added products within the framework of Green Deal Implementation and Circular economy model is strongly encouraged.	The authors mention that the circular economy model considers the issues of mitigating the impact of production and consumption on the environment and emerged as a reaction to the existing unsustainable linear "take, make, consume, and waste" economic model.

Pakuła, N., et al. (2025)	The study offers a critical discussion providing insights into the progress of the European Union (EU) strategies for transitioning into circular economy (CE). It has been presented that there are unexplored aspects and identified limitations, this study being one of the few that tackle Member states' performance in regards to EC. The paper concludes that further research, as well as raising implications of conducting analyses and ranking CE performance of countries should be carried out. The study contributes to the effectiveness of research and policy developments, offering new possibilities for refining the design of concrete measures towards better circularity performances.	The paper starts by presenting information on policy objectives set at the level of the European Commission (EC), stating that it perseveres in striving for advancements in its circular economy policies. The authors believe that circular economy is in the heart of the sustainability agenda through initiatives such as the European Green Deal (European Commission, 2019) and the Circular Economy Action Plan (CEAP).
Saari, U.A., et al. (2021)	The research aims to provide insight into how individuals' sustainable consumption behaviour is influenced by environmental knowledge and risk perception. In their findings, the authors have indicated that sustainable consumption behaviour can be associated with environmental concern, particularly in Europe. This results from increased levels of environmental knowledge and environmental risk perception.	The authors consider that changes in the sustainable consumption behaviour of Europeans is closely linked to the knowledge that they have on the need to transition to a green and circular economy, that derives from policies such as the European Green Deal and EU Circular Economy Action Plan.
Mehmet B., et al. (2023)	The paper analyses if and how is the EU Green Deal a successful tool to maintain the EU's role as a normative power during carbon neutrality. It examines both opportunities and challenges of the EU Green Deal. Based on specific keywords, 631 studies were found, with 117 sources considered relevant for the analysis. The study aims to contribute to the literature on EGD, in particular the "Normative Power Europe" concept, suggesting a link between the normative power of Europe and its "norm diffusion" mechanisms related to the EGD.	EU Green Deal is considered to be one of the most significant policies that can help amend and prevent climate change and environmental problems, leaving sustainable resources for future generations. The EGD sustainability is linked to its feasibility and acceptance of all third parties involve The article identified the unequal distribution of resources and inequality of opportunities as challenges affecting the normative power of EU. It is considered that focusing just transition principles and encouraging stakeholder engagement in energy transition would strengthen Eu position.

Source: Authors' own summary of the examined papers

3. Research methodology

To understand the role and the contribution that circular economy has in the context of Green Deal's objective of climate neutrality, the bibliometric analysis is the most suitable research method, allowing for all dimensions of circular economy to be analysed. Having in mind that circularity is multi – sectoral, we are faced with challenges when trying to map the extent to which it contributes to climate neutrality and the progress made since its introduction. The bibliometric research method, therefore, is able to shed light in understanding how and to what extent does circular economy contribute to a zero - emission economy. This approach aims to efficiently monitor the policies, measures, resources and performance indicators introduced in order to meet the objectives CEPA and EGD. In the opinion of Velez-Estevez et al. (2023) is a highly useful tool for exploring research trends.

In order to conduct the bibliometric research, VOSviewer version 1.6.20 has been used, providing empirical evidence to support research findings. According to Moral-Muñoz, J.A., et al. (2020) from the many tools available for bibliometric analysis, VOSviewer is becoming increasingly popular, because it presents outstanding visualization capabilities, giving the user the possibility to export information from many sources for creating maps based on network data. Therefore, based on correlation coefficients, the tool allows for the creation of network maps, which are visually represented according to the metadata extracted from various scientific databases (van Eck and Waltman, 2010).

In this particular case, we have resorted to WoS database in order to conduct the bibliometric analysis, based on two criteria "Green Deal" and circular economy (All Fields). We have not included other filters to the publication and indexing dates. Furthermore, we have considered only those publications that respected the proposed word structures. The output consists of 570 WoS-indexed publications corresponding to the keywords mentioned above, which provided basis for elaborating the quantitative study of the field of circular economy in connection to the Green Deal objectives. Table 2 incorporates fundamental methodological aspects of the bibliometric analysis carried out in this paper.

Table no. 2 Methodological aspects of the bibliometric analysis

Criteria	Results
Number of WoS-indexed publications	570 publications corresponding to the keywords
Number of keywords	292 keywords associated to the 570 publications

Source: Author's own criteria for the bibliometric analysis

4. Findings

In what concerns the bibliometric analysis, we have analysed the most relevant clusters which resulted from the specifications provided in table 2. Methodological aspects of the bibliometric analysis and, implicitly WoS output. Table 3 presents the structure of each cluster and the most relevant keywords per selected cluster. Furthermore, the paper presents the keyword mapping of the concept of circular economy in the context of Green Deal, as displayed in Figure 2.

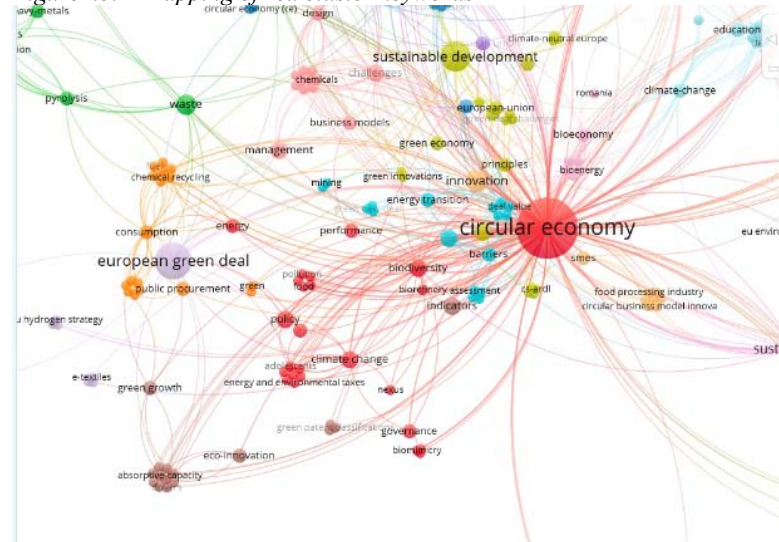
Table no. 3 Cluster structure based on relevant keyword structure

Red cluster	Green cluster	Mustard cluster	Blue cluster	Orange cluster	Brown cluster
circular economy	recycling	green transition	environmental benefits	consumer attitudes	green growth
environment	waste	green deal challenges	circular economy principles	development goals	eco-innovation
emissions	resource recovery	sustainable development	cleaner production	environmental impacts	maximum likelihood estimation
climate change	municipal Solid waste	climate neutral Europe	sustainable consumption	green public procurement	environmental pressure
policy	closed loop economy	corporate social responsibility	raw materials	plastic waste management	drivers
investment on environment	activated carbons	Green economy	value creation	sustainable food system	heterogeneity
pollution	anaerobic digestion	principles	circular business model	solid waste	productive performance

Source: Extracted from VOSviewer version 1.6.20

When visualising the red cluster, we can observe that it goes around the concept of circular economy. As means to mitigate climate change and reach the objective of climate neutrality, the introduction of policies that target specific areas such as air pollution, reduction of CO2 emissions, environmental protection through circular economy, as well as investments on environment are considered of absolute necessity. The "circular economy" and "climate change" keywords multiple occurrences suggest a strong relevance of the circular economy in terms of climate change. Even though they are interlinked, and mitigating climate change can be achieved only if there is a joint effort, introduction of targeted measures is needed to produce a real change. In order to do so, collaborations between the most crucial actors, as defined by Henry Etzkowitz and Loet Leydesdorff (1998) as being academia, corporations, and government through the tripe helix model, need to be established.

Figure no. 1 Mapping of red cluster keywords



Source: Author's own computation in VOSviewer 1.6.20

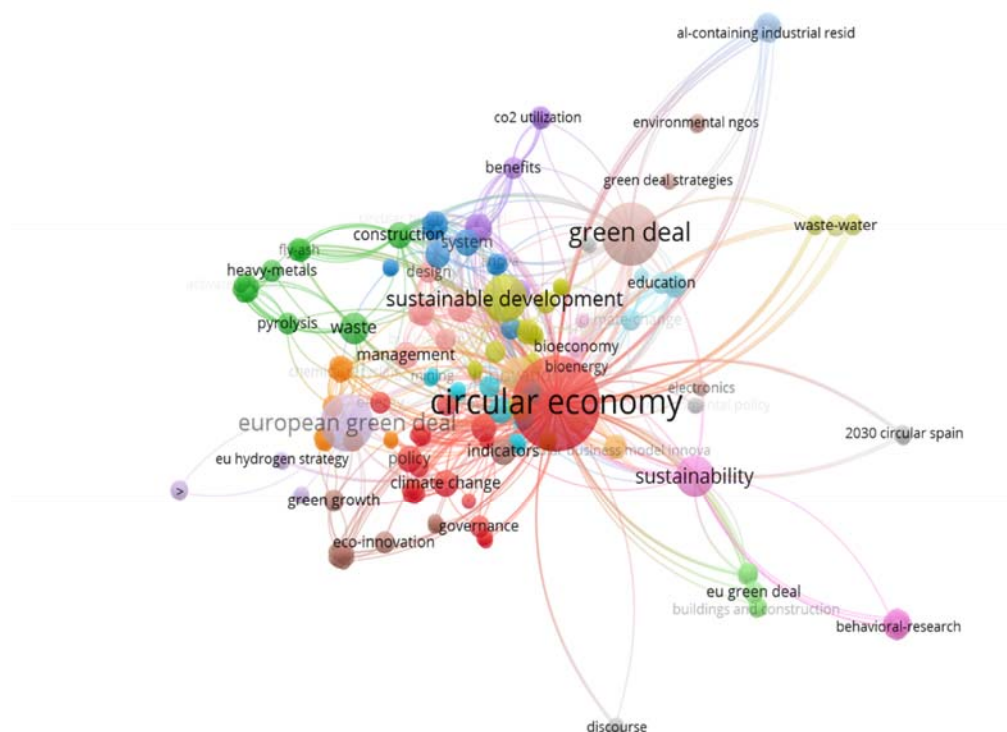
Thus, having in mind the EGD has a multi - sectoral dimension, through stakeholder engagement and introduction of tailor-made policies across all sectors, it aims to increase the contribution of these sectors to the reduction of CO2 emissions through a regulatory framework, as well as investments.

The implementation of eco- innovation and green growth is empowered through EGD with the objective of incentivising a circular business model and increasing cleaner production of goods. This in turn will result in consumer attitude change, resulting in sustainable consumption. There is an interconnection between blue cluster and brown cluster, the inputs from the brown cluster, when implemented, lead to the results mentioned in the blue cluster.

Additionally, the mustard cluster consists of “corporate social responsibility” and “green transition” keywords, adding to the idea of the importance of education and the introduction climate change courses in the educational curricula, because starting early means that responsible consumption, putting the environment first.

Blum et. al (2013) argues that even though climate change education is highly necessary and important towards achieving climate neutrality by involving children in decision making mechanisms, it remains an under-theorised area of inquiry as considered independently from fields such as environmental education and science education. The green cluster encompasses elements that impact the contribution that circular economy has in reaching climate neutrality, under the influence of waste control measures. The "waste recovery" keyword occurrence brings forward the fact that cultivating the idea of a "closed loop economy" (another occurring keyword structure) requires a solid environmental protection-oriented foundation, able to efficiently introduce measures that can be operationalised irrespective of the region, local climate policy or stakeholder implication. Thus, "value creation" and "resource recovery" are at the centre of the EGD.

Figure no. 2 Mapping the concept of circular economy in the context of Green Deal



Source: Author's own computation in VOSviewer 1.6.20

5. Conclusions

Throughout the paper, the authors aim to identify the challenges the European Green Deal has brought with its introduction, the strategic measures that have been in place to overcome or diminish the intensity of these challenges and the policies that have been implemented to achieve climate neutrality. Ultimately, it envisages a bibliometric analysis that aims to analyse where circular economy stands and the contribution it has brought to achieving climate neutrality. A shared effort centred around circular economy should be considered by all member states.

Ever since the Russian aggression in Ukraine, the EU policy has focused mainly on reducing dependency on Russian fossil fuels, increasing the share of renewable energy and increasing EU competitiveness in the field of net-zero technologies, with limited focus being placed on end-of-life cycle of products and enhancing the life span of certain products. The message still has been "replace" instead of repair and reuse.

The keyword cluster analysis of the circular economy in the context of Green Deal is characterized by several dimensions. Each of the clusters embodies areas and dimensions of circular economy, proving the multi – sectoral approach of the policy. Having started with the red cluster, we could observe that the investment on environment is the key determinant of reducing pollution, CO2 emission levels, and implicitly contributing to alleviating climate change effects. Moreover, based on the insights gathered from the blue cluster analysis, the circular economy contribution to EGD objectives was highlighted through the occurrence of the "clean production" and "sustainable consumption". keywords. The brown cluster brings forward the circular economy commitment to green growth and eco-innovation in an equitable manner that can benefit all dimensions. The emphasis is put on the need for sustainable development and corporate responsibility, as means for accommodating the increase demand of goods and the continuous expansion of economies.

In conclusion, through the bibliometric analysis the authors highlighted that even through EGD policy has introduced measures aimed at reducing dependency on fossil fuels, increasing CO₂ emission reduction and encouraging a circular approach of the economy, there are area which have been left behind. One of these areas is early teaching of the challenges the environment is facing due to climate change and ways in which the impact of climate change can be diminished. Learning from a young age about sustainable consumption, the obligation that we have towards keeping our environment clean for future generations, the concept of use, repair, reuse, recycle, could help increase the likelihood of achieving climate neutrality by 2050.

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Constructing National Reputations in Post-Communist Europe: A Comparative Analysis of Romania and Poland

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Abstract

The present article explores the notion of national reputation, emphasizing the economic, political, and cultural elements that contribute to an individual nation's global image. The study utilizes a comparative analysis of Romania and Poland, two post-communist Eastern European nations. It investigates how macroeconomic indicators such as Gross Domestic Product (GDP) growth, unemployment rates, and perceptions of corruption influence a country's reputation. Furthermore, the role of non-coherent power—that is, cultural diplomacy and global influence—is explored as a key element in shaping the national image. The analysis underscores how Poland's enhanced economic performance and political stability have contributed to a more favorable reputation, while Romania's reputation has undergone a transformation as it enhances governance and combats corruption. The article under scrutiny herein underscores the intricate nature of national reputations and the multifaceted interconnection of economic, political, and cultural factors in shaping global perceptions.

Key words: national reputation, GDP, global image, performance, corruption

J.E.L. classification: E01, F63

1. Introduction

When talking about a country's reputation, we put into perspective the collective perception of how a country behaves and values itself in the international arena. It is a multi-dimensional concept that encompasses not only the economic, political, and social aspects of a country, but also the cultural factors. A country's reputation is not only determined by its external actions. It is also about how it manages its internal affairs and how these solutions are viewed by the rest of the world.

National reputation has emerged as an important concept in international relations and is increasingly viewed as a strategic asset influencing national economic performance, diplomatic influence, and soft power capacity (Anholt, 2007, p. 171-172; Buhmann and Ingenhoff, 2015, p. 62-80). It represents a multidimensional construct, shaped by the interplay of economic indicators, political credibility, and cultural influence, all of which work together to shape how the world perceives it. In today's interconnected global environment, the management of a country's image has become a critical concern for governments that seek to enhance their international standing (Szondi, 2008, p. 5-6).

While there is an expanding corpus of literature addressing the concepts of nation branding and reputation management, comparatively little scholarly attention has been devoted to the specific reputational dynamics of post-communist Eastern European states. It is evident that these countries confront distinctive challenges, as their present-day identities continue to be shaped by the repercussions of centralized governance and the disparate progression of democratic and financial reformation (Kaneva, 2011, p. 118–120). The present article addresses this gap by undertaking a comparative analysis of Romania and Poland—two post-communist nations that share historical and regional commonalities yet diverge in their global image trajectories.

The central research question guiding this study is which macroeconomic indicators and soft power strategies contribute to the construction of national reputation in post-communist Eastern Europe. The article posits that Poland's enhanced reputation is associated with its sustained economic performance and relative political stability. In contrast, Romania's evolving international image mirrors the nation's endeavors to enhance governance and curtail systemic corruption.

The present analysis employs a comparative case study methodology, drawing on key macroeconomic indicators such as real GDP growth, unemployment rates, and corruption indices, in combination with a qualitative examination of soft power strategies, including cultural diplomacy and international cultural engagement. While the study's primary focus is at the institutional and policy levels, it does not encompass media discourse or international public opinion analysis—areas that may be considered in subsequent research.

By centering on the case studies of Romania and Poland, this article aims to foster a more profound understanding of the processes through which national reputation is shaped in transitional contexts. The text underscores the significance of incorporating the economic, political, and cultural dimensions into the study and practice of national image construction in a globalized world.

2. Literature review

The notion of national reputation has become increasingly intertwined with the broader discourse of nation branding. In this paradigm, states are seen as being similar to corporations. They need to manage their image in order to be competitive in a global environment (Anholt, 2007, p. 1-4; Dinnie, 2008, p. 13-15). The concept of national reputation is different from branding because it focuses on longer-term recognition and reflects a synthesis of present reality mixed with accumulated historical associations (Buhmann and Ingenhoff, 2015, p. 62-80). The reputation of a country has the ability to influence a wide range of international relations, such as foreign investment, trade, tourism and international cooperation (Passow, Fehlmann, & Grahlow, 2005). Negative perceptions can lead to reputational risk, stigmatization or diplomatic isolation.

Despite the prevalence of targeted campaigns in branding strategies, extant literature emphasizes that reputations are primarily earned, rather than invented. The concept of national identity is shaped by tangible performance in the economic, political and cultural spheres (Anholt, 2010, p. 6). Accordingly, the concept of nation branding transcends the confines of a mere marketing exercise, exhibiting a pronounced synergy with the domains of public diplomacy, institutional trust, and international legitimacy (Szondi, 2008, p. 12; Wang, 2006, p. 92).

Joseph Nye's (2004) seminal work on soft power, defined as the ability to influence others through attraction rather than coercion, has assumed a central role in discourses on state reputation management. According to Nye (2004, p. 11–12), culture, political values and foreign policy coherence are considered to be fundamental sources of soft power. For nations undergoing a transition from an autocracy to a democracy, soft power functions not solely as a means of projecting national identity; rather, it also facilitates a strategic distancing of the present regime from the authoritarian legacy of previous eras (Cull, 2009, p. 22). Cultural diplomacy is therefore a vehicle for rebranding national narratives and for asserting geopolitical relevance (Melissen, 2005, p. 9).

As several scholars have observed, participation in EU integration and international organizations plays a reputational role in post-communist states, signifying alignment with liberal democratic norms (Kaneva, 2011, p. 120-122). It is fundamental that this alignment with EU norms is a key factor in these states' accession to the EU. Nevertheless, the successful implementation of soft power is frequently dependent on domestic credibility and institutional capacity, rendering it indistinguishable from political and economic circumstances.

Beyond the concept of soft power, the macroeconomic performance of a nation is often identified as a fundamental contributor to its national reputation. The economic indicators such as the real GDP growth, low unemployment, and stable inflation are widely considered to be reliable signals of progress, even so more in the context of emerging economies (Fan, 2010, p. 100). Concomitantly, corruption, rule-of-law deficiencies and political instability have the capacity to severely compromise external perceptions, irrespective of branding initiatives (Maor, et al, 2013, p. 234).

Research conducted on Eastern Europe has demonstrated that perceptions of corruption and governance quality frequently exert a comparable influence to that of economic growth in shaping external perceptions. For example, Poland has been frequently cited as a post-communist success story on account of its economic resilience and alignment with the European Union (Ivanov, 2016, p. 470). By contrast, Romania has faced greater reputational volatility, partly due to persistent governance challenges.

Despite the proliferation of research on nation branding and soft power, there remains a gap in studies that have examined how exactly the variation of macroeconomic indicators and soft power strategies collectively influence national reputation in post-communist Europe. Furthermore, the majority of extant studies regard Eastern Europe as a homogeneous bloc, thus overlooking intra-regional variations that could potentially elucidate variegated reputational outcomes. The present article addresses this gap by means of a comparative analysis of Romania and Poland, with a view to offering insight into the manner in which economic governance, political credibility, and cultural diplomacy interact in the construction of global perceptions.

3. Research methodology

The present article employs a comparative case study methodology to examine the factors that shape national reputation in post-communist Eastern European countries: Romania and Poland. The selection of these cases is predicated on two shared contextual factors: regional and historical. These include the transition from communism, the accession to the European Union, and the economic transformation that occurred subsequent to 1989. The cases also diverge in terms of international reputation and perceived soft power.

The present analysis is guided by a qualitative, explanatory research design, integrating a small-N comparative logic. In the context of post-communist legacies and EU membership, Romania and Poland are frequently studied due to their similarities. However, a notable distinction emerges when examining their reputational profiles in global indices and discourse: these two countries exhibit starkly contrasting reputational profiles in these areas. The present design facilitates the identification of pivotal economic, political, and cultural variables that may explain reputational divergence.

The study relies on secondary data drawn from multiple reputable and official sources. The data analyzed vary from macroeconomic indicators such as real GDP growth, unemployment rate, and foreign direct investments, drawn from the websites of the World Bank, OECD and Eurostat. In the analysis, there should also be measured the governance and corruption metrics like the Transparency International's Corruption Perceptions Index (CPI), the World Governance Indicators (WGI), and EU monitoring reports.

The reputation and branding indices are also of interest when analyzing a nation's reputation. We mention here the Nation Brands Index (NBI), Soft Power 30 Index, and data from the European Commission's Eurobarometer. We can also use academic literature and policy documents on national branding, public diplomacy, and Eastern European identity construction.

These data are supplemented by qualitative analysis of national strategies for public diplomacy and cultural projection, drawn from government documents, policy briefs, and prior scholarly work.

The analysis employs a dual approach, integrating both descriptive and interpretive methodologies. The utilization of economic and governance indicators serves to establish an empirical baseline for the purpose of conducting a comparative analysis of performance-related reputational inputs. These phenomena are then interpreted in relation to each country's cultural diplomacy initiatives, international positioning, and image strategies.

This integrative approach is informed by a number of theoretical models, including Anholt's (2007) model of competitive identity, Nye's (2004) theory of soft power, and Buhmann and Ingenhoff's (2015) public relations-based framework for country image construction.

The analysis proceeds in three stages:

- Economic and governance comparison: using time-series and cross-national indicators (2004–2023).
- Soft power mapping: analysis of cultural diplomacy efforts and international engagement strategies.

- Interpretation of reputation outcomes: drawing on external rankings, regional press coverage, and scholarly evaluations.

Furthermore, the international reputation of a nation is inherently multidimensional and influenced by global events that are beyond the nation's control. Consequently, the analysis places significant emphasis on structural and institutional drivers while acknowledging that reputational narratives are also influenced by external actors, including media entities and foreign publics.

4. Findings

This section presents the empirical findings regarding the reputational profiles of Romania and Poland. These findings are based on macroeconomic indicators, governance measures, and soft power strategies. An examination of the available data indicates not only a convergence in structural development but also a divergence in international reputation and image management.

Poland has consistently demonstrated stronger macroeconomic indicators compared to Romania, particularly in the post-EU accession period. Between 2004 and 2023, Poland kept an average GDP growth rate of approximately 3.83%, weathering the 2008 financial crisis and the COVID-19 pandemic with relative resilience, as seen below in figure no. 1. In contrast, Romania's GDP growth has been more volatile, averaging 3.68% over the same period, with deeper contractions during crisis years (World Bank, 2024). For 2024 and 2025, the prognosis for Romania is still not favorable considering the political tensions that characterized these years, following the annulled presidential elections in November 2024 and retaking the elections in May 2025. Even though Poland also is about to pass through elections of their own, its stability over time is hinting at an easier impact on the economy.

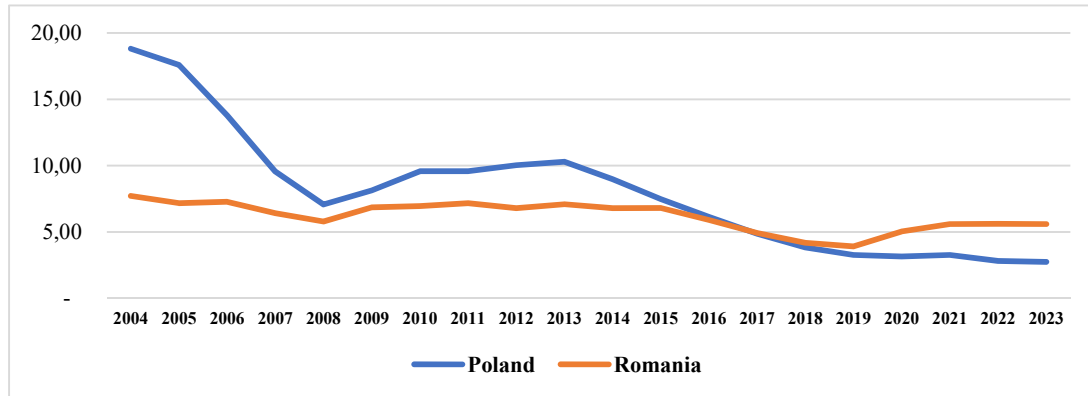
Figure no.1. Real GDP Growth Rates (%) for Romania and Poland (2004–2023)



Source: chart compiled by the author using data from the World Bank

Unemployment in Poland has steadily declined, reaching 2.74% in 2023, one of the lowest in the EU, considering the fact that Poland in 2004, as seen in figure no. 2, had an unemployment rate of 18.82%. Romania also saw improvements, but unemployment remained higher, at 5.59% in 2023 (Data World Bank, 2024); however, Romania did not start from such a high level as Poland, as the unemployment rate in 2004 was 7.72. These disparities influence perceptions of economic stability and policy effectiveness. If the GDP evolution was in Poland's favor, regarding the unemployment rate, the statistics show that Romania is better positioned than its sister country.

Figure no. 2 Unemployment (% of the total labor force) for Romania and Poland (2004-2023)



Source: chart compiled by the author using data from the World Bank

The perception of governance quality further differentiates the two countries. Poland has historically received higher rankings in the World Bank's Governance Indicators, particularly in categories such as Government Effectiveness and Rule of Law. However, recent political developments, particularly concerns over judicial independence and media freedom, have caused a reputational dip since 2016 (Freedom House, 2023).

Romania, a country with a historically significant burden of perceived corruption, has demonstrated noteworthy progress in this regard. According to the Corruption Perceptions Index, Romania's score increased from 38/100 in 2012 to 46/100 in 2023. Meanwhile, Poland's score experienced a slight decline, dropping from 58 to 53 during the same period (Transparency International, 2023). This suggests that while Romania is making progress in its economic and political development, its reputation is still undergoing a process of adjustment to the new reforms.

Figure no. 3 Corruption Perceptions Index for Poland (2012-2024)



Source: <https://www.transparency.org/en/cpi/2024/index/pol>

From figure no.3, we can see that Poland has had quite a roller coaster of evolution regarding the corruption from within the country. We can attribute these highs and lows to its complicated past and similarly complicated transition to the democratic world. Even though Poland had been a member of the EU three years prior to Romania's, recent years have seen both countries struggling with people distrusting the political system and wanting other perspectives, especially due to the corruption persistent in the country and the political people not doing anything towards improving the situation.

Figure no. 4 Corruption Perceptions Index for Romania (2012-2024)



Source: <https://www.transparency.org/en/cpi/2024/index/rou>

According to the above-mentioned source, the Corruption Perception Index works between the range of 0 and 100, with close to 0 meaning that the country has a very corrupt system, while being closer to 100, the situation is better and the country is closer to winning the fight against corruption. So, from figure no.3 and 4, we can assess that both countries are somewhere in the middle of their fight against corruption. With Poland being a little higher on the leaderboard than Romania, having addressed more strictly the subject of corruption with more powerful reforms and laws.

Both countries have engaged in strategic cultural diplomacy, but with differing scope and effectiveness. Poland has invested in institutions like the Adam Mickiewicz Institute, which promotes Polish culture internationally through film, literature, and art. Poland's soft power is also enhanced by its active role in EU policymaking, NATO operations, and support for Ukraine.

In contrast, Romania has initiated a series of measures that are both more recent and less deeply institutionalized. Initiatives similar to the Romanian Cultural Institute, along with campaigns that promote the nation, such as Discover Romania, are indicative of an effort to modify the country's image.

Nonetheless, the efficacy of these endeavors remains limited. Media discourse frequently focuses on issues such as corruption, migration, and underdevelopment, indicating a state of reputational inertia.

In global indices, Poland generally exhibits a more robust brand and higher visibility. According to the Nation Brands Index (2022), Poland ranked 24th, surpassing Romania, which ranked 37th (Anholt-Ipsos, 2022). A similar phenomenon is observed in the Soft Power 30 Index, where Poland is consistently included, while Romania is frequently absent.

Furthermore, Eurobarometer surveys indicate that the level of public trust in Polish institutions exceeds that of their Romanian counterparts on both a domestic and an EU-wide basis (Eurobarometer, 2021). An analysis of the extant literature reveals that Poland's favorable reputation can be attributed to two principal factors. A robust correlation exists between positive structural performance metrics and sustained engagement in international platforms, underscoring the importance of strategic integration of technology and internationalization in contemporary business operations.

Table no. 1 Comparative Summary of main macroeconomic indicators

Indicator	Poland	Romania
Avg. GDP Growth (2004–2023)	3.83%	3.68%
Unemployment (2023)	2.74%	5.59%
CPI Score (2023)	55	46
NBI Rank (2022)	24th	37th
Cultural Diplomacy	Institutionalized (e.g., Adam Mickiewicz Institute)	Fragmented (e.g., Romanian Cultural Institute)
Global Soft Power Index Presence	Frequent	Absent

Source: table compiled by the author using data from the World Bank, CPI index, NBI Ranking

These findings confirm that while both countries have made significant progress since EU accession, Poland has maintained a stronger and more consistent international reputation. Romania, though improving, continues to face challenges in translating structural reforms into reputational gains.

5. Conclusions

This article has examined the multifaceted determinants of national reputation, focusing on Romania and Poland as comparative case studies for post-communist Eastern Europe countries. It has demonstrated how macroeconomic indicators, such as GDP growth and unemployment rates, interact with political stability, governance quality, and soft power elements to shape how nations are perceived globally.

Poland's robust and relatively stable economic growth, averaging approximately 3.83% between 2004 and 2023, and a sharp decline in unemployment from over 18% to under 3% have boosted its international credibility. These achievements reflect successful policy reforms, EU integration, and a consistent commitment to economic modernization. Furthermore, Poland's soft power—enhanced by cultural diplomacy, academic engagement, and a proactive EU role—has further reinforced its national image (World Bank, 2024, p. 5).

In contrast, Romania, while achieving a strong average GDP growth of 3.68% over the same period and reducing unemployment significantly, has faced more volatility and institutional challenges. Nevertheless, in recent years, Romania has made meaningful progress in areas such as judicial reform and anti-corruption, which have improved both its EU standing and external perception (IMF, 2023, p. 7–9). Despite these efforts, its international reputation remains somewhat hindered by perceived governance deficits and lower visibility in international cultural and diplomatic arenas.

The findings underscore that national reputation is shaped by a dynamic interaction of economic performance, institutional quality, and soft power capabilities. While Poland currently enjoys a stronger reputation, Romania is gradually converging through structural reforms and improved governance. Reputation, in this context, is not a static attribute but a reflection of sustained performance, credibility, and engagement in global affairs.

Looking ahead, both countries have considerable potential to enhance their reputations, particularly in light of ongoing EU development priorities and global economic trends. Romania is expected to continue growing steadily, with the European Commission (2024, p. 3) projecting GDP growth of around 3.3% in 2025, supported by EU Recovery and Resilience Facility (RRF) funds and investment in digital and green transitions. However, persistent governance challenges and political instability could undermine these gains.

Romania for the future years should definitely prioritize deepening institutional reforms, especially in judicial independence and public administration efficiency (IMF, 2023, p. 10–12). Also, the anti-corruption mechanism and transparency in public procurement should be strengthened, and the cultural diplomacy and international academic presence must be expanded in order to enhance soft power in the international context.

Despite recent geopolitical tensions and some concerns over rule-of-law disputes within the EU, Poland remains a regional economic leader. The World Bank (2024, p. 6) projects a rebound in GDP growth to 3.5% in 2025, driven by strong domestic demand and EU cohesion funding. To maintain and improve its reputation, Poland should strongly recommit to judicial independence and democratic norms to preserve EU alignment and investor confidence (European Commission, 2024, p. 4).

If Poland wants to maintain and strengthen its position as a Central European tech hub, they should strongly accelerate the digital infrastructure and innovation policy. In order to further reinforce its global recognition, they must continue to leverage its cultural and academic platforms.

Both countries face shared external challenges, including energy security, demographic decline, and the pressures of geopolitical realignment in the region. How they respond—through cooperative EU action, climate policy implementation, and inclusive governance—will strongly influence their reputations going forward.

As global perceptions become more sensitive to transparency, inclusivity, and resilience, national reputation will depend increasingly on the ability to navigate uncertainty with strategic clarity and consistent reforms.

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Rural Tourism Development in the Republic of Moldova in Terms of Benefits and Constraints

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Abstract

Nowadays rural tourism is one of the Top 5 tourist motivations that drive people to travel. The desire to escape, the desire to relax, the desire to find oneself in a peaceful and picturesque natural environment drive people to the countryside.

Rural tourism is thus becoming an increasingly important part of tourist motivations, which creates the prerequisites for more extensive research and a more complex analysis of this phenomenon.

This article highlights both the benefits and opportunities for the development of rural tourism and the negative impacts that can arise because of the unwise development of this form of tourism.

The nature of the research carried out was made possible thanks to the analysis of a comprehensive bibliographical study, as well as information collected from the tourism business environment, which refers to the opportunities and prospects for the development of rural tourism.

Key words: tourism, rural tourism, tourism offer, tourism potential, tourism motivation

J.E.L. classification: Z32, Q56

1. Introduction

Rural tourism is a fast-growing motivational form of tourism, which forms the tourist offer of many European countries.

Today, tourists prefer tourist destinations with tourism potential untouched by industrialization, urban agglomeration and genetically modified food.

Safe travel, the tranquillity of nature, the diversity of organic consumer products, traditions and authentic values are among the motivations that induce tourists to travel to these tourist destinations.

The Republic of Moldova is no exception to this trend, as it has a vast natural and man-made tourism potential, which can be enhanced by developing rural tourism.

Traditional rural houses, tourist and agro-tourist guesthouses, peasant holiday cottages, where the delicacies of local cuisine can be enjoyed with a good wine, all combined with the art of handicrafts and craftsmanship and the diversity of leisure activities, can help to create an attractive and competitive tourist offer capable of attracting foreign visitors, with the result that rural tourism is developing.

All these considerations have led to the need for a comprehensive and unitary study on the opportunities for developing rural tourism in the Republic of Moldova, from the point of view of realities, prospects and possible negative impacts.

2. Theoretical background

Rural tourism is a phenomenon that has gained momentum in the 21st century. The interest in recreation and psycho-emotional rejuvenation in rural areas began to emerge at the end of the 20th century as a response to the stress of industrialization, technologization and urban agglomeration.

People want to migrate to a picturesque natural environment, away from stress and everyday problems. This can only be achieved in rural areas that can provide peace of mind, emotional comfort and healthy food.

Seen in this light, rural tourism is an alternative to traditional tourism, which as a rule takes place in crowded resorts and tourist centers.

The incursion of visitors into rural areas is beneficial for local economies, as tourism generates income, creates jobs, provides a market for agricultural production, etc. However, rural tourism can also create environmental problems through pollution, overcrowding and the destruction of traditional habitats.

To avoid these problems and to maximize the efficiency of rural tourism, as the author, I set out to carry out this research with the aim of highlighting both the opportunities for developing rural tourism and the possible shortcomings and constraints which are linked to its development. So, the objectives of the study can be summarized as follows:

- to define rural tourism as a motivational form of tourism;
- to elucidate the conditions necessary for the development of rural tourism;
- to reflect the differences between traditional mass tourism and rural tourism
- to establish the benefits of developing rural tourism
- to analyze the constraints hampering the development of rural tourism
- to render the negative impacts that may arise with the development of rural tourism.

3. Research methodology

The research methodology was selected in harmony with the objectives of the study. It is represented by content analysis and the process of analytical prioritization, with the aim of obtaining scientifically substantiated conclusions.

The author of the study focused his research on studying the phenomenon of rural tourism, establishing the benefits, analyzing the negative impacts, while reflecting the constraints that hinder the development of this motivational form of tourism.

Theoretical foundation of the researched problem was achieved through a study of multidisciplinary literature, as well as the analysis of the tourism legislation in force. General empirical research methods were also applied, such as: the analytical method, through which the essence of the problem was reached; the systemic analysis method, through which the phenomenon of rural tourism was investigated; the synthesis method, applied to establish the connections between the objectives of the study.

4. Findings and discussions

Rural tourism is one of the motivational forms of tourism that ensures the development of inbound and domestic tourism for many European countries. The Republic of Moldova is part of that group of countries.

In the view of the authors Gherasim, *"the motivation behind traveling is the first defining element of tourism"* (Gherasim, Gherasim, 2025, p.14). In our case it is the motivational form of tourism - rural tourism.

The diversity and complexity of tourism services in rural areas create premises and prospects for the completion and diversification of the tourism offer of the Republic of Moldova, which contributes to attracting foreign tourists.

Against this backdrop, there is a need for proper knowledge and a complex understanding of the mechanisms operating in the rural tertiary sector.

Rural tourism today is a particular context which meets people's need to find refuge in villages. Weekends, holidays and rest days are perfect opportunities to escape from the daily routine and to find oneself, even if only partially, through contact with protected nature and a rural environment full of cultural and traditional values.

The university professor Vasile Glăvan defines rural tourism as *"a form of tourism whose destination is the rural environment, using farms and agro-tourist farms as tourist reception structures"* (Glăvan, 2003, p.38).

The group of authors Alecu Ioan Niculae and Constantin Marian defines rural tourism as *"a concept that encompasses the tourist activity organized and managed by the local population and based on a close link with the natural and human environment"* (Niculae, Marian 2006, p.73).

The Lexicon of tourism terms defines rural tourism as *"a form of tourism focused on destinations in rural areas, with a functional structure of accommodation and other heterogeneous services"* (Stănciulescu, 2002, p.180).

Law 352/2006, "On the organization and conduct of tourism in the Republic of Moldova", defines rural tourism as *"a form of tourism carried out in rural areas and oriented towards the use of local tourist resources (natural, cultural, etc.), knowledge of the rural environment, its specific activities, local customs and traditions, peasant and farmer households, etc."* (Law 352/2006).

The author of the present study is of the opinion that *"rural tourism is a motivational form of tourism, which provides for the touristic valorization of the natural and anthropic touristic potential existing in the rural environment, with tourist consumption being ensured through tourist reception structures with accommodation and food service functions, as well as other service providers in the villages"*.

Generalizing the above, we can say that rural tourism includes a wide range of activities with specific tourist activities that can be carried out in a typical rural environment. Based on these considerations, it can be stated that rural tourism can be developed in any geographical region of the Republic of Moldova that meets the following conditions:

- there is natural and man-made tourism potential
- it has a technical and material base and tourist infrastructure;
- the private and public desire persists;
- there is a specific and original way of life;
- unaltered natural landscapes are preserved;
- traditions, customs and cultural values are preserved and conserved;
- activities to promote the rural destination are carried out.

The increase in tourism motivation for the countryside can also be determined by the ethno-folkloric features that are specific to certain areas. The great diversity of these genuine treasures specific to each territorial area, combined with the unpolluted, natural environment, can be an important factor in motivating the consumption of rural tourist services.

How does rural tourism differ from traditional mass tourism? An analysis of tourism services highlights those features that are specific to rural tourism, namely:

- tourist consumption takes place only in rural areas, where the essential elements are: familiarization with community customs and traditions, getting to know the natural environment and landscape, originality of food products;
- the tourism on offer is authentic, differentiated, varied in its diversity, organized and managed by the people of the village;
- tourist movement is limited and not compatible with mass tourism;
- the service provision activity is complex, as the whole range of tourist services is present: accommodation, food, leisure, excursions;
- does not require large investments in the technical and material base and infrastructure.

Why is it important to contribute to the development of rural tourism? Scientific researcher Andreea-Mihaela Băltărețu is of the opinion that *"the development and promotion of rural tourism is urgently needed due to the positive effects it generates on local economies"* (Băltărețu, 2016, p.65).

To analyze those positive effects that can be obtained because of rural tourism development, the author of the study identified 10 benefits, which are reflected in **Table 1**.

Table no. 1. Benefits of tourism for rural areas

No.	Benefits of rural tourism	Benefits feature
1.	Creating new jobs	Rural tourism can generate job creation opportunities for rural population, youth, women and ethnic minority groups. Jobs in tourism are not only those linked to the activity of tourist accommodation and food and leisure facilities. Tourism also synchronizes other sectors of the national economy, such as agriculture, trade, crafts, handicrafts, provision of various services, etc.
2.	Local infrastructure development	For tourism, it is necessary to develop an adequate infrastructure: roads, telecommunications, water and sewage systems, electricity, natural gas, waste processing equipment, etc. Experience shows that in areas with tourism potential, tourism infrastructure is developing much faster than in other regions.
3.	Investment attractiveness	Rural tourism creates opportunities for capital investment in business development. Thanks to these investments, different sectors of the national economy such as construction, agriculture, trade, etc. are developed.
4.	Generation of local taxes	Rural tourism generates revenues through the payment of local taxes to the Budget of the Territorial Administrative Units, which can be used to improve community facilities: repairing schools and kindergartens, modernization of parks, construction of recreational facilities, increasing the stock of books in libraries, etc.
5.	Market for local products	The food for tourists in rural accommodation can be provided by organic, locally grown products. In this way, tourism creates opportunities for the marketing of local products, such as agricultural products, fish products and their derivatives.
6.	Funding for tourism heritage conservation	The development of tourism is also justified by the fact that it contributes to securing sources of funding for the preservation of natural areas, archaeological and historical sites and cultural traditions, which are tourist attractions. Their protection is necessary to maintain the tourist flow.
7.	Technology transfer	Tourism employees are learning new skills and familiarizing themselves with new technologies, which will lead to the development of local human resources. Some of these skills may be transferable to other economic activities.
8.	Environmental protection	The environmental quality of an area can be improved by tourism, as tourists prefer to visit attractive, clean and unpolluted places. From this perspective, the local population will be responsible for protecting nature so as not to jeopardize tourist traffic.
9.	Revitalizing national identity	Tourism implies greater concern on the part of the locals to preserve their national identity, when they notice that tourists are interested in getting to know local folklore, customs and traditions. In this sense, tourism can be a catalyst for revitalizing national identity, an aspect that cannot be neglected in the context of exploiting local tourism potential.
10.	Opportunities for a decent living as a result of developing a business	The development of rural entrepreneurship as a result of tourist movement can materialize into a source of money for the locals. The income obtained as a result of tourism services can be channeled to the consumption needs of the native population, thus raising the standard of living in rural areas.

Source: Author's contribution

Although rural tourism signals important benefits, we must also consider the negative impacts that this form of tourism can have if not organized correctly and responsibly. **Table 2** shows the negative impacts that rural tourism can generate.

Table no. 2. Potential negative impacts of rural tourism

No.	Negative impacts generated	Description of the impact
1.	Environmental pollution	Tourism can cause negative environmental impacts if tourists are not educated in the spirit of nature protection. Waste that is left by tourists in forest areas, nature reserves, plains and hills, rivers and lakes can destroy the flora and fauna of the area.
2.	Territorial overpopulation	Uncontrolled tourist traffic can overcrowd rural areas, creating discomfort for the native population. Once this discomfort is felt, it can create resistance from the population in terms of tourist services.
3.	Increasing the tax on land-use planning and maintenance	The local public administration, by decision of the local council, can decide on an increase in the sanitation tax to maintain and sanitize tourist facilities. This may cause discontent among residents.
4.	Changing local customs	Visitors from different cultures and religious denominations can influence local customs and traditions, which over time might be changed due to the tourist movement.
5.	Loss of authenticity	To be protected, elements of authenticity must be preserved. In the case of tourism this is practically impossible, as the motivation for traveling to the countryside is also focused on elements of authenticity.
6.	Damage to the zoning architecture	Unightly construction can affect the architecture of the area. When developing the technical and material basis for tourism, it is not always the case that the contractor considers the specific architectural features of the rural area in order to avoid additional costs.

Source: Author's contribution

We note, however, that the benefits obtained because of rural tourism development outweigh the negative impacts. Moreover, the benefits obtained from tourism activity could offset those negative impacts generated by the development of rural tourism, if tourist movement to rural areas is guided by a well thought out and well-organized operational management.

It is important to realize that rural tourism can only be successful and sustainable if those constraints, which have been identified because of the present study, are removed. **Table 3** presents the constraints that are currently a barrier to the development of rural tourism.

Table no. 3. Constraints to rural tourism development

No.	Constraints	Description of the Constraints
1.	Obtaining building permission	The process of applying for and issuing building permits for accommodation in rural areas is a lengthy and arduous one.
2.	Authorization of annexes	From the existing experience, it is known that all building annexes, which are to be developed for tourism, are to be registered at the cadastral offices, which causes considerable difficulties, because many rural localities do not have a cadastral plan.
3.	The one-stop shop principle does not work	The one-stop-shop principle, according to Law 231/2010 "On domestic trade" (Law 231/2010), provides for the transmission of the notification of the start of activity by the entrepreneur to the local public administration authority, which in turn is obliged to forward the information to the National Food Safety Agency and Territorial Public Health Centers, in order to issue the operating permits.
4.	Lack of tax facilities	The motivation for entrepreneurs to invest in rural areas is the existence of tax incentives that would keep the business afloat in the first three years of activity. Practice shows that economic operators are subject to a major risk of default and bankruptcy, especially in the first few years of activity.
5.	Post-factum grant	State subsidies granted through the Agency for Intervention and Payments in Agriculture (AIPA) are offered only by way of compensation and only after the necessary expenses have been

		incurred. This makes it necessary for the entrepreneur to have a pledge in order to be able to access funds from commercial banks.
6.	Territorial planning	The local public administration does not have sufficient financial resources to develop the area for tourist traffic.
7.	Lack of qualified staff	The excessive population migration currently taking place in the Republic of Moldova is depopulating villages to catastrophic proportions. This leads to a total shortage of staff, not to mention qualified personnel.
8.	Poorly developed infrastructure	Although the state authorities have recently been paying more attention to the national road network, this problem is still not fully solved. Tourists as a rule avoid rural areas with damaged roads.

Source: Author's contribution

Consequently, it can be mentioned that, notwithstanding the identified constraints, the negative impacts that may be generated, rural tourism can be boosted and developed, bringing an important added value to the tourism offer of the Republic of Moldova.

5. Conclusions

The study has generated information that contributes to the formulation of an overview of how to organize and carry out tourism activities in rural areas, in terms of the benefits and possible problems that may arise because of the development of this motivational form of tourism.

The author of the study considers not only the advantages that rural tourism can bring, but also its disadvantages.

The scientific value of the study is represented by the research objectives, which have been elucidated, analyzed and reflected in a structured way in this article.

The scientific contribution of the study consists in the complex reflection of ideas that place rural tourism as a motivational form of tourism, capable of complementing and diversifying the tourism offer of the Republic of Moldova, with the major objective being the development of domestic and inbound tourism.

To ensure that the expected results are achieved, it is important to strengthen administrative capacity and budgetary resources for rural tourism development, while facilitating investment and involving local communities in the management of tourism activities in the second-tier administrative territorial units.

In view of the results obtained and presented in this study, the author puts forward several proposals and recommendations which, in our opinion, could help to increase the efficiency of rural tourism for the tourism industry of the Republic of Moldova.

Proposals and recommendations for the development of rural tourism:

1. Regulate some fiscal incentives for the initiation and development of tourism activities in rural areas: reduced income tax rate, inclusion of all taxes and fees in a single tax to simplify accounting, abolishment of local taxes in the first three years of activity.

2. Broadening the category of subjects eligible for subsidization from state structures.

3. Establishment of simplified rules for obtaining the sanitary authorization and the sanitary-veterinary authorization for the operation of tourist accommodation and food facilities in rural areas.

4. Allocation of preferential credits for the development of the technical-material base in rural areas with tourism potential.

5. To organize professional initiation courses for potential entrepreneurs in rural areas on the part of the specialized public administration body.

6. Granting tax benefits to rural tourism employers for the employment of high school students who have reached the age of 16.

7. Introduction of the vacation voucher. The holiday voucher as a value document of strict record, is to be granted to employees in the real sector of the national economy, in order to organize domestic tourism holidays, necessary to cover the costs of travel, accommodation, food, leisure, if these services are included in a package of tourist / travel services.

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Study on Digitalization in the Context of Adopting Artificial Intelligence

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Abstract

The development of artificial intelligence (AI) in recent years is correlated to the accelerated process of global digitalization. Nowadays AI is increasingly becoming into many aspects of daily life. Its development will continue to evolve as the technology improves.

Recent research on the Global Digitalization Index (GDI) 2024 indicates a strong relationship between advancements in the ICT sector and the acceleration of digital economic growth. Nations with more established ICT infrastructures typically demonstrate higher digital maturity.

This paper analyses the dependence between digitalization and artificial intelligence. To study this correlation, were selected the most relevant indicators that measure digitalization (Global Digitalization Index) respectively artificial intelligence (AI Preparedness Index). Statistical methods to study this interdependence are linear regression and correlation coefficient.

Key words: digitalization, Global Digitalization Index, Artificial Intelligence

J.E.L. classification: L81, L86

1. Introduction

The global shift toward digital and intelligent transformation presents unprecedented opportunities for economic and social development. In response, over 170 countries have introduced national strategies aimed at fostering technological integration across sectors (World Bank, 2023). The Global Digitalization Index (GDI) is used to measure the influence of such transformations on digital economies, reflecting how investments in ICT development contribute to overall economic performance. The 2024 GDI captures the changing dynamics in a post-pandemic world. The COVID-19 pandemic accelerated digital development but also highlighted the gap between digitally advanced nations and those with basic connectivity. The GDI is an important resource which shapes digital strategies and policies worldwide, in order to build a digitally empowered and sustainable future.

2. Theoretical background

The Global Digitalization Index (GDI) serves as a comprehensive metric to evaluate how effectively nations are embracing digital transformation. It provides a structured framework for comparing countries' progress in integrating digital technologies, and its findings consistently highlight the strong linkage between digital infrastructure investment and economic indicators such as GDP per capita (Huawei, 2024).

Moreover, emerging studies demonstrate a significant correlation between the GDI and the International Monetary Fund's (IMF) AI Preparedness Index (IMF, 2023). Countries with advanced digital foundations tend to be better equipped for integrating artificial intelligence due to established infrastructure in areas like connectivity, data storage, and computational capacity. For AI to function effectively on a scale, robust networks capable of supporting high-speed, low-latency communication are essential. This, coupled with scalable and efficient computing resources, becomes a critical enabler for real-time data processing and intelligent automation.

Furthermore, the environmental impact of digital transformation cannot be overlooked. The rise in AI and digital services has heightened energy consumption, making investments in sustainable energy infrastructure increasingly important. As such, green energy is not only a climate imperative

but also a key technological enabler for long-term digital advancement (World Economic Forum, 2023). AI applications have reshaped sectors that have undergone significant digital transformation:

- **Healthcare:** AI assists in diagnostics, treatment personalization, and operational efficiency
- **Finance:** Automated fraud detection, algorithmic trading, and customer service bots rely on digital infrastructure
- **Education:** Adaptive learning platforms use AI to personalize content delivery based on student performance
- **Public administration:** Digital governments are integrating AI for smart city planning and citizen services

These advancements are only possible through the strong digital foundations built by years of investment in infrastructure and connectivity.

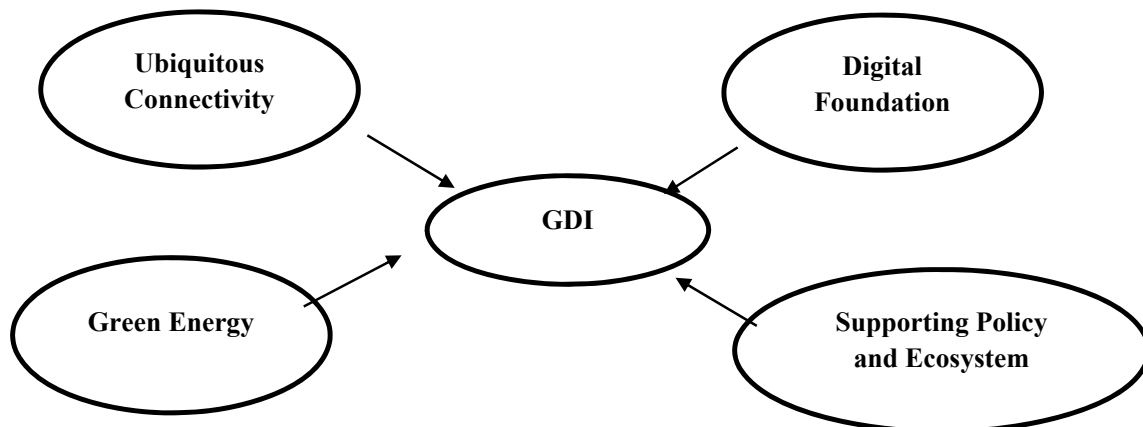
3. Research methodology

The research utilizes datasets from public reports Huawei, Global Digitalization Index 2024 Report, IMD World Competitiveness Booklet 2024, International Monetary Fund (IMF), 2023. AI Preparedness Index 2023. The analysis focuses on the top 10 ranking of countries according to Global Digitalization Index compared to AI Preparedness Index. It is noticed that the countries who have the biggest values of the Digitalization Index are most prepared to adopt Artificial Intelligence. To study this correlation there are used statistical methods like linear regression and correlation coefficient.

4. Analysis of digitalization in the context of Artificial Intelligence

The four dimensions of the GDI are the basis of successful digitalization, ensuring the inclusive, sustainable and resilient digital transformation. Ubiquitous Connectivity enables communication and data exchange worldwide. Enhancing and expanding connectivity infrastructure is very important for bridging the digital divide and ensuring that everyone regardless of their economic status have access to digital economy. Digital Foundation is about implementing advanced technologies such as AI, IoT and edge computing that offer efficiency, adaptability and innovation. This dimension of GDI is the foundation upon which are built digital enterprises, smart cities and innovative solutions, creating an intelligent and more responsive global system. Green energy is recognized as a landmark of digitalization. As digital technologies spread worldwide, the energy demands have to be met sustainably. Transition to green energy is very important not only because of climate change, but also for ensuring that digital transformation contributes to global sustainability goals. Supporting policy and Ecosystem are the elements that hold everything together.

Figure no. 1. Dimensions of the Global Digitalization Index



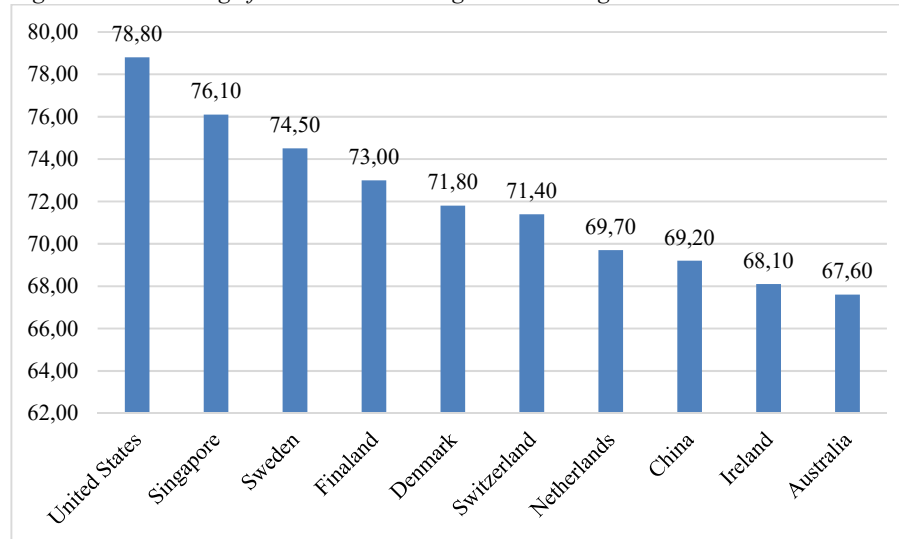
Source: made by the author

Singapore stands out as a global leader in digital transformation, consistently ranking among the top countries in the Global Digitalization Index due to its strategic investments in ICT infrastructure, regulatory innovation, and skills development (Smart Nation Singapore, 2023). The government has prioritized universal high-speed internet access, with over 98% of households now connected to broadband, and ambitious plans are underway to achieve 10 Gbps connectivity nationwide.

In terms of artificial intelligence adoption, Singapore took an early lead by introducing its first National AI Strategy in 2019. This initiative laid the foundation for integrating AI into sectors such as healthcare, transport, and public services. Building on this, the 2023 release of NAIS 2.0, titled "*AI for the Public Good, for Singapore and the World*", aims to position the country as a global hub for responsible AI innovation (IMDA, 2023).

To align with its net-zero commitments, Singapore has also embarked on the development of a green data center roadmap. This initiative is expected to attract significant investment—estimated between USD 7.5 billion and USD 9 billion—over the next decade, supporting both environmental sustainability and digital infrastructure growth (MCI Singapore, 2024).

Figure no. 2. Ranking of countries according to Global Digitalization Index in 2024

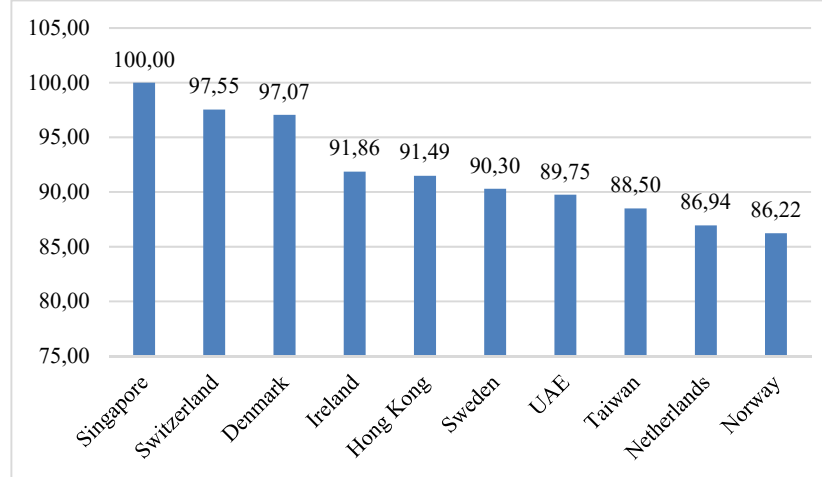


Source: made by the author based on data available Huawei, 2024. Global Digitalization Index 2024 Report <https://www.huawei.com/en/reports/global-digital-economy>

For more than 30 years, the IMD World Competitiveness Center researched how countries and companies compete to lay the foundations for sustainable value creation. The competitiveness of nations is one of the most significant developments in modern management. In 2024, the WCC ranked the competitiveness of 67 economies across four factors: economic performance, government efficiency, business efficiency, and infrastructure. These factors capture various aspects of competitiveness, such as macroeconomic stability, fiscal policy, institutional quality, market openness, business dynamism, innovation, education, health, and environmental performance. The 2024 ranking shows that the most competitive economies combine solid economic performance with efficient and effective public and private sectors, high-quality infrastructure, and human and social capital. These economies also balance productivity and prosperity, meaning they can therefore generate elevated levels of income and quality of life for their citizens while preserving the environment and social cohesion. Some examples of such economies are Singapore, Switzerland, Denmark, Sweden, and the Netherlands. The ranking also shows that emerging markets are catching up with more advanced economies, especially in innovation, digitalization, and diversification. Some examples of these economies are China, India, Malaysia, Thailand, and Chile.

National competitiveness rankings are an essential ingredient in the formation of national strategies because they provide comprehensive and objective assessments of countries' strengths and weaknesses vis à vis other countries. They also serve as a benchmark for measuring progress and identifying areas for improvement.

Figure no. 3. Ranking of countries according to Competitiveness Index in 2024

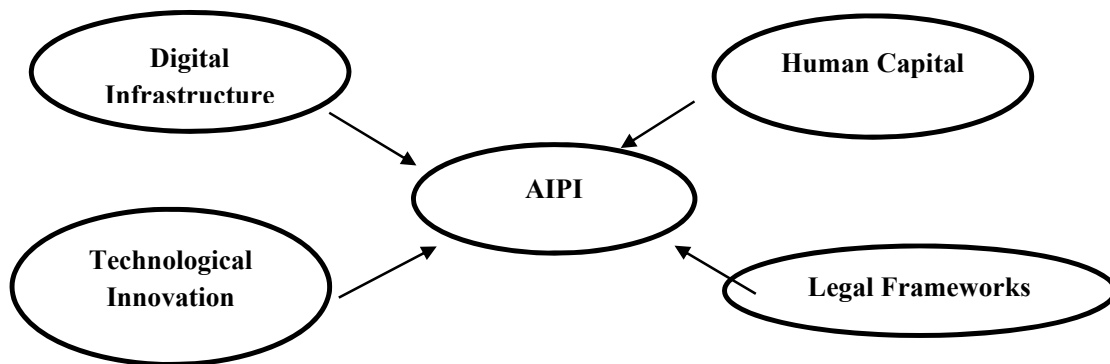


Source: made by the author based on data available IMD World Competitiveness Booklet 2024, <https://www.imd.org/centers/wcc/world-competitiveness-center/rankings/world-competitiveness-ranking/>

AI Preparedness Index (AIPI) assesses the level of AI preparedness across 174 countries, based on a rich set of macro-structural indicators that cover the countries' digital infrastructure, human capital and labor market policies, innovation and economic integration, and regulation and ethics.

Source data include official data, surveys of hard data and surveys of perceptions compiled by 8 institutions: Fraser Institute, International Labor Organization, International Telecommunication Union, United Nations, United Nations Conference on Trade and Development, Universal Postal Union, World Bank, and World Economic Forum.

Figure no. 4. Dimensions of the AI Preparedness Index



Source: made by the author

The AIPI is derived as the simple average of the four key dimensions: Digital Infrastructure, Human Capital, Technological Innovation and Legal Frameworks. Each dimension is composed of a set of sub indicators. The most important sub indicators are:

- Estimated internet users per 100 inhabitants
- Number of mobile subscribers per 100 inhabitants
- Number of wireless broadband subscriptions per 100 inhabitants

- Cost of internet access
- Secure internet servers per 1 million people
- Use of mobile phone for online transactions
- Public sector's online services infrastructure
- Human capital index
- Digital skills among active population
- Number of STEM graduates
- Flexibility of wage determination
- R&D spending per unit of GDP
- Free movement of capital and people
- Legal framework's adaptability to digital business models.

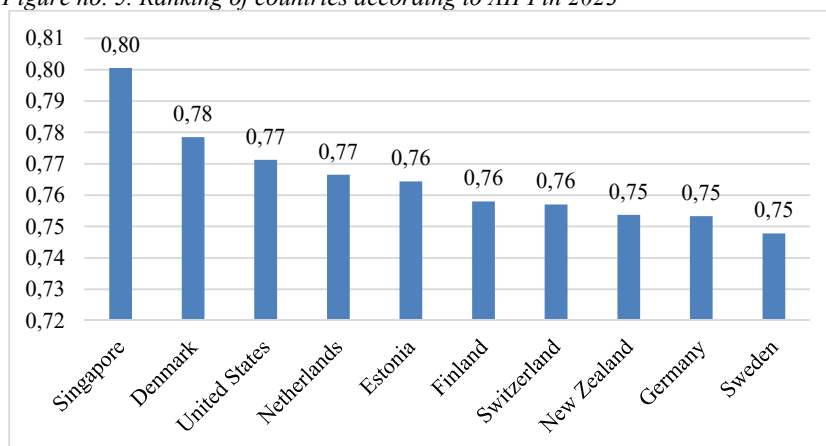
Table no. 1 Ranking of countries according to AIPI in 2023

Rank	Country	AIPI
1	Singapore	0.80
2	Denmark	0.78
3	United States	0.77
4	Netherlands	0.77
5	Estonia	0.76
6	Finland	0.76
7	Switzerland	0.76
8	New Zealand	0.75
9	Germany	0.75
10	Sweden	0.75

Source: made by the author based on data available International Monetary Fund (IMF), 2023. AI Preparedness Index 2023 <https://www.imf.org/en/Publications/WP/Issues/2023/AI-Preparedness-Index>

Singapore ranks first as the most prepared country for smooth AI adoption. The country invested hundreds of millions of dollars into increasing AI capabilities and supporting national AI strategies. The Singapore government has developed a suite of general-purpose AI tools for public service officers, which still adhere to strict security standards.

Figure no. 5. Ranking of countries according to AIPI in 2023



Source: made by the author based on data available International Monetary Fund (IMF), 2023. AI Preparedness Index 2023 <https://www.imf.org/en/Publications/WP/Issues/2023/AI-Preparedness-Index>

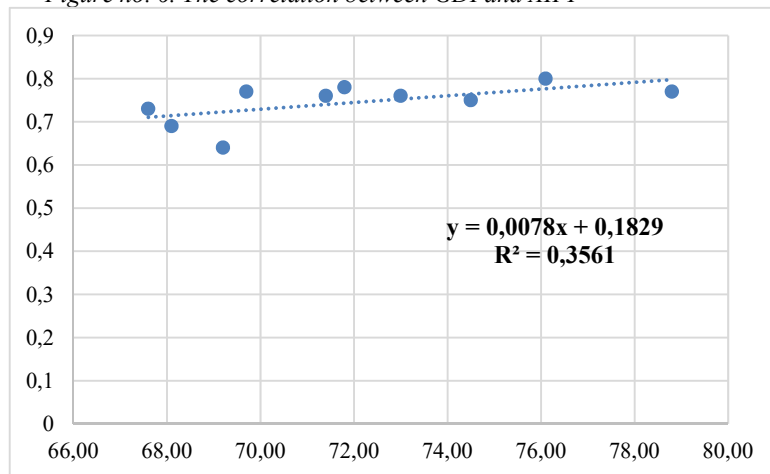
Besides Singapore, northwestern European countries like Denmark (#2), the Netherlands (#4), Estonia (#5), Finland (#6), and Sweden (#1) also scored in the top 10 for AI preparedness. Several of these European countries were also among the world's earliest adopters of national AI strategies, such as Finland's 2017 AI strategy aimed at enhancing business competitiveness and data efficiency, and Sweden's 2018 "National Approach for Artificial Intelligence" focusing on education, research, and infrastructure development.

Table no. 2. The correlation between GDI and AIPI

Rank	Country	GDI	AIPI
1	United States	78.80	0.77
2	Singapore	76.10	0.8
3	Sweden	74.50	0.75
4	Finland	73.00	0.76
5	Denmark	71.80	0.78
6	Switzerland	71.40	0.76
7	Netherlands	69.70	0.77
8	China	69.20	0.64
9	Ireland	68.10	0.69
10	Australia	67.60	0.73

Source: made by the author

Figure no. 6. The correlation between GDI and AIPI



Source: made by the author

It is noticed that the countries that have the biggest Global Digitalization Index are the most prepared for Artificial Intelligence because they have also big values of AIPI. The correlation between these indicators is presented in the following figure where is calculated the regression equation (linear regression) and the correlation coefficient (R^2).

5. Conclusions

In the past few years, the progress of artificial intelligence has been closely connected with worldwide digitalization development. The transformation of processes, services and systems through digital technologies has established the basis for AI to evolve from a niche of scientific pursuit into a mainstream driver of innovation, productivity and social change.

The accelerated pace of technological innovation—encompassing AI, robotics, biotechnology, nanotechnology, and the Internet of Things—continues to reshape economic and societal landscapes. These advancements offer transformative benefits, such as increased efficiency and

productivity, while simultaneously introducing complex ethical and regulatory challenges. Issues like data privacy, cybersecurity, digital equity, and governance are becoming increasingly urgent as digital ecosystems expand.

To fully harness the potential of these technologies, governments and businesses must pursue a dual strategy: invest in robust digital infrastructure and nurture human capital through education and upskilling. At the same time, innovation must be guided by principles of inclusiveness, resilience, and sustainability. Building an adaptive ecosystem that supports research, ethical standards, and public trust is key to achieving long-term digital development goals. However, significant disparities persist due to uneven access to reliable connectivity. Addressing these gaps requires targeted investment in digital infrastructure, implementation of effective policy frameworks, and the cultivation of skilled professionals to support ongoing technological progress.

6. Acknowledgment

This research was supported by a grant from the Petroleum-Gas University of Ploiești, Romania, project number GO-GICS-30707/10.12.2024, within the Internal Grant for Scientific Research.

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Multiple Regression Analysis of Indicators that Determine Competitiveness

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Abstract

The correlation between Human Development Index (HDI), Sustainable Development Goals Index (SDG) and Competitiveness Index (CI) reflects how countries balance social progress, environmental sustainability and economic performance. Generally, countries with high scores of HDI perform well in the SDG Index because education, strong health and income levels support sustainable development. They are also competitive because education and health are key productivity drivers' factors.

The objective of the paper is to analyze the factors that determine competitiveness of countries such as human development and sustainable development. To study this interdependence were selected the most relevant indicators that measure competitiveness (Competitiveness Index), human development (Human Development Index) and sustainable development (Sustainable Development Goals Index). The statistical methods used are multiple regression and correlation coefficient.

Key words: Competitiveness Index, Human Development Index, Sustainable Development Goals Index, multiple regression

J.E.L. classification: C10, C30

1. Introduction

Multiple regression is a widely utilized statistical technique for analyzing the influence of multiple independent variables on a single dependent variable. It plays a crucial role in data analysis, decision-making and predictive modelling across various fields. The advantages of this method are: it allows the examination of multiple factors simultaneously, helps isolate the unique effect of each predictor by holding others constant, enhances the accuracy of conclusions about cause- effect relationships.

2. Theoretical background

Ordinary least squares regression examines the extent to which a dependent variable responds to changes in a single explanatory variable. However, when outcomes are influenced by multiple factors, there is required a more appropriate analytical method such as multiple regression.

Multiple regression models can be either linear or nonlinear. Linear multiple regression assumes a direct relationship between the dependent variable and the independent variables.

The model estimates how changes in each explanatory factor affect the outcome, holding the other factors constant.

Key assumptions underlying multiple linear regression include:

- A linear relationship between dependent independent variables
- Limited multicollinearity among predictors
- Independent and random sampling of observations from the population

The adjustment equation of the multifactor linear model is:

$$\hat{y}_i = a + b * x_{1i} + c * x_{2i}$$

The system of normal equations is:

$$\begin{cases} n * a + b * \sum x_{1i} + c * \sum x_{2i} = \sum y_i \\ a * \sum x_{1i} + b * \sum x_{1i}^2 + c * \sum (x_{1i} * x_{2i}) = \sum (x_{1i} * y_i) \\ a * \sum x_{2i} + b * \sum (x_{1i} * x_{2i}) + c * \sum x_{2i}^2 = \sum (x_{2i} * y_i) \end{cases}$$

This system is solved using Cramer's method.

The determinants are:

$$\Delta = \begin{vmatrix} n & \sum x_{1i} & \sum x_{2i} \\ \sum x_{1i} & \sum x_{1i}^2 & \sum (x_{1i} * x_{2i}) \\ \sum x_{2i} & \sum (x_{1i} * x_{2i}) & \sum x_{2i}^2 \end{vmatrix}$$

$$\Delta_a = \begin{vmatrix} \sum y_i & \sum x_{1i} & \sum x_{2i} \\ \sum (x_{1i} * y_i) & \sum x_{1i}^2 & \sum (x_{1i} * x_{2i}) \\ \sum (x_{2i} * y_i) & \sum (x_{1i} * x_{2i}) & \sum x_{2i}^2 \end{vmatrix}$$

$$\Delta_b = \begin{vmatrix} n & \sum y_i & \sum x_{2i} \\ \sum x_{1i} & \sum (x_{1i} * y_i) & \sum (x_{1i} * x_{2i}) \\ \sum x_{2i} & \sum (x_{2i} * y_i) & \sum x_{2i}^2 \end{vmatrix}$$

$$\Delta_c = \begin{vmatrix} n & \sum x_{1i} & \sum y_i \\ \sum x_{1i} & \sum x_{1i}^2 & \sum (x_{1i} * y_i) \\ \sum x_{2i} & \sum (x_{1i} * x_{2i}) & \sum (x_{2i} * y_i) \end{vmatrix}$$

The parameters of the model are calculated according to the following formulas:

$$a = \frac{\Delta_a}{\Delta}$$

$$b = \frac{\Delta_b}{\Delta}$$

$$c = \frac{\Delta_c}{\Delta}$$

The multiple regression model enables the analyst to forecast the resultative variable using data from several explanatory variables. However the model does not always achieve perfect accuracy, as each data point may vary slightly from the predicted outcome given by the model. The residual value (e) representing the difference between the actual result and the predicted result is incorporated in the model to accommodate these minor discrepancies.

The disadvantages of multiple regression are:

- Multicollinearity- if predictors are highly correlated, it becomes hard to determine their individual effects
- Requires large data sample – for more reliable results there are required large datasets
- Interpretation of the results can be complex and hard especially for non-experts.

For more than thirty years, the IMD Competitiveness Center has pioneered research on how countries and companies compete to lay the foundation for sustainable value creation. The competitiveness of nations is probably one of the most significant developments in modern management. The rankings of the country help attract investment, inform policy decisions and foster a competitive spirit among the nations. This can also lead to improved living standards, job creation and sustainable development, shaping the economic landscape for years to come.

In 2024 the WCC ranked the competitiveness of 67 economies across four factors: economic performance, government efficiency, business efficiency and infrastructure. These factors capture various aspects of competitiveness such as macroeconomic stability, fiscal policy, institutional quality, market openness, business dynamism, innovation, education, health and environmental performance. The 2024 ranking shows that the most competitive economies combine solid economic

performance with efficient and effective public and private sectors, high-quality infrastructure. These economies also balance productivity and prosperity meaning they can therefore generate elevated levels of income and quality of life for their citizens while preserving the environment and social cohesion. (IMD, 2024).

Sustainable development remains a central goal shared by governments, international organizations, and the private sector. Global efforts have been substantial in defining actionable goals and in mobilizing the resources and instruments necessary for their realization. Rather than focusing solely on financial gain, investments should prioritize generating measurable social and environmental benefits in parallel with economic returns—an approach aligned with the principles of impact investing. (Panait, M., Hysa, E. and Raimi, L., 2023).

Sustainable Development Goals Index (SDG) measures and ranks countries based on their progress towards achieving the 17 UN Sustainable Development Goals, which are a set of global goals aimed to end poverty, protecting the environment and ensuring people peace and prosperity by 2030.

SDG Index provides an annual assessment of SDG progress in all 193 UN member states. SDG Index incorporates 125 indicators including 98 global indicators and 27 additional indicators used for the OECD countries' dashboards.

"Human Development Index (HDI) is a composite Index measuring average achievement in three basic dimensions of human development:

- Life expectancy at birth- number of years a newborn infant could expect to live if prevailing patterns of age-specific mortality rates at the time of birth stay the same throughout the infant's life
- Expected years of schooling- number of years of schooling that a child of school entrance age can expect to receive if prevailing patterns of age-specific enrolment rates persist throughout child's life
- Mean years of schooling- average number of years of education received by people age 25 and older, converted from education attainment levels using official durations at each level
- Gross national income (GNI) per capita – aggregate income of an economy generated by its production and its ownership of factors of production, less the incomes paid for the use of factors of production owned by the rest of the world". (United Nations Development Programme, 2025)

3. Research methodology

The research utilizes datasets from public reports: Sustainable Development Report 2024, Human Development Report 2025, IMD World Competitiveness Booklet 2024. The analysis focuses on the top 10 ranking of countries according to the Sustainable Development Goals Index in 2024. To study this correlation there are used statistical methods like linear multiple regression and correlation coefficient. The independent variables are Sustainable Development Goals Index (SDG) and Human Development Index (HDI). The resultative variable is the Competitiveness Index (CI). The Cramer method is used to determine the regression equation of the linear model.

4. Findings

The following table presents the first ten ranked countries by the Sustainable Development Goals Index in 2024. For each country the Human Development Index and the Competitiveness Index in 2024 are presented to determine the correlation using multiple regression analysis.

Table no.1 Ranking of the countries

Rank	Country	SDG	HDI	CI
1	Finland	86.4	0.948	80.3
2	Sweden	85.7	0.959	90.3
3	Denmark	85	0.962	97.1
4	Germany	83.4	0.959	72.7
5	France	82.8	0.92	69.7

6	Austria	82.5	0.93	72.1
7	Norway	82.2	0.97	86.2
8	Croatia	82.2	0.889	52.8
9	U.K	82.2	0.946	70.8
10	Poland	81.7	0.906	61.7

Source: Sustainable Development Report 2024 <https://dashboards.sdgindex.org/chapters>,
Global Digitalization Index 2024 Report, <https://www.huawei.com/en/reports/global-digital-economy>

The independent variables are the Sustainable Development Goals Index (SDG) denoted by x_{1i} and the Human Development Index (HDI) denoted by x_{2i} . The resultative variable is the Competitiveness Index denoted by y_i . The following table contains processed data to study the multiple correlation between the indicators.

Table no. 2 Processed data

No.	x_{1i}	x_{2i}	y_i	$x_{1i} * x_{2i}$	$x_{1i} * y_i$	$x_{2i} * y_i$	x_{1i}^2	x_{2i}^2
1	86.4	0.948	80.3	81.9072	6937.92	76.1244	7464.96	0.898704
2	85.7	0.959	90.3	82.1863	7738.71	86.5977	7344.49	0.919681
3	85	0.962	97.1	81.77	8253.5	93.4102	7225	0.925444
4	83.4	0.959	72.7	79.9806	6063.18	69.7193	6955.56	0.919681
5	82.8	0.92	69.7	76.176	5771.16	64.124	6855.84	0.8464
6	82.5	0.93	72.1	76.725	5948.25	67.053	6806.25	0.8649
7	82.2	0.97	86.2	79.734	7085.64	83.614	6756.84	0.9409
8	82.2	0.889	52.8	73.0758	4340.16	46.9392	6756.84	0.790321
9	82.2	0.946	70.8	77.7612	5819.76	66.9768	6756.84	0.894916
10	81.7	0.906	61.7	74.0202	5040.89	55.9002	6674.89	0.820836
total	834.1	9.389	753.7	783.3363	62999.17	710.4588	69597.51	8.821783

Source: realized by the author

The system of normal equations is:

$$\begin{cases} 10 * a + 834.1 * b + 9.389 * c = 753.7 \\ 834.1 * a + 69597.51 * b + 783.3363 * c = 62999.17 \\ 9.389 * a + 783.3363 * b + 8.821783 * c = 710.4588 \end{cases}$$

The determinants obtained using Cramer method are:

$$\Delta = \begin{vmatrix} 10 & 834.1 & 9.389 \\ 834.1 & 69597.51 & 783.3363 \\ 9.389 & 783.3363 & 8.821783 \end{vmatrix} = 1.228$$

$$\Delta_a = \begin{vmatrix} 753.7 & 834.1 & 9.389 \\ 62999.17 & 69597.51 & 783.3363 \\ 710.4588 & 783.3363 & 8.821783 \end{vmatrix} = -571.025$$

$$\Delta_b = \begin{vmatrix} 10 & 753.7 & 9.389 \\ 834.1 & 62999.17 & 783.3363 \\ 9.389 & 710.4588 & 8.821783 \end{vmatrix} = 2.969$$

$$\Delta_c = \begin{vmatrix} 10 & 834.1 & 753.7 \\ 834.1 & 69597.51 & 62999.17 \\ 9.389 & 783.3363 & 710.4588 \end{vmatrix} = 443.049$$

The parameters of the model are:

$$a = \frac{\Delta_a}{\Delta} = \frac{-571.025}{1.228} = -465.004$$

$$b = \frac{\Delta_b}{\Delta} = \frac{2.969}{1.228} = 2.418$$

$$c = \frac{\Delta_c}{\Delta} = \frac{443.049}{1.228} = 360.789$$

The adjustment equation of the multifactor linear model is:

$$\hat{y}_i = -465.004 + 2.418 * b + 360.789 * c$$

The following table contains processed data to calculate the correlation coefficient, to study the intensity of the correlation between the indicators.

Table no. 3 Processed data

$\hat{y}_i$	$y_i - \hat{y}_i$	$(y_i - \hat{y}_i)^2$	$y_i - \bar{y}$	$(y_i - \bar{y})^2$
85.939172	-5.63917	31.8002608	4.93	24.3049
88.215251	2.084749	4.34617839	14.93	222.9049
87.605018	9.494982	90.1546832	21.73	472.1929
82.653851	-9.95385	99.0791497	-2.67	7.1289
67.13228	2.56772	6.593186	-5.67	32.1489
70.01477	2.08523	4.34818415	-3.27	10.6929
83.72093	2.47907	6.14578806	10.83	117.2889
54.497021	-1.69702	2.87988027	-22.57	509.4049
75.061994	-4.26199	18.1645929	-4.57	20.8849
59.421434	2.278566	5.19186302	-13.67	186.8689
754.261721		268.703767		1603.821

Source: realized by the author

The correlation coefficient is

$$R = \sqrt{1 - \frac{268.703767}{1603.821}} = 0.912$$

The value of correlation coefficient indicates a strong interdependence between Sustainable Development Goals Index , Human Development Index and Competitiveness Index (CI).

5. Conclusions

Investments in education, health and environmental goals help long term human development and foster innovation, social stability and skilled labor- all critical factors for competitiveness. Competitive economies have better infrastructure, strong institutions and a capacity for innovation which help implement sustainable and inclusive development policies.

Sustainable development continues to be a challenge for long-term investments. Reshaping the international financial system is more necessary than it has ever been. Addressing today's global challenges demands access to essential public goods that go beyond the jurisdiction of individual nation-states. To progress toward sustainable development, low- and middle-income countries have to secure affordable, long-term funding mechanisms that enable large-scale investment. Achieving

these goals will require reorganization of institutional frameworks, innovative financing models and a renewed global commitment to prioritize investments in education and human capital development.

An important milestone in global economic policy is the transition from mere productivity to a holistic dimension of competitiveness. True competitiveness is determined not only by productivity, but also by quality of life (economic prosperity, happiness, social inclusion, fairness and environmental sustainability). This perspective highlights that competitiveness is a polyvalent concept within which productivity is a crucial component, but not the only determinant.

6. Acknowledgment

This research was supported by a grant from the Petroleum-Gas University of Ploiești, Romania, project number GO-GICS-30707/10.12.2024, within the Internal Grant for Scientific Research.

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Section III

Economic and Social Studies

Principal Component Analysis for Some Energy Poverty Indicators for EU27

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Abstract

In this article, the correlation relationships between the normalized values of the main energy poverty indicators for the EU27 countries were tested, for the period 2010-2024. Thus, a Principal Component Analysis (PCA) was applied in EViews 9 to check the eigenvalues, the eigenvector loadings of the correlation matrix. The purpose of applying this method is to identify the correlations between variables as well as to reduce the dimension of variation by simplifying the number of factors. Regarding the dimension reduction, it was found that components 1 and 2 have eigenvalues greater than 1. Specifically, factor 1 has a value of 3.3157, and factor 2 has a value of 1.8076. Thus, the factors retained are two. Regarding the eigenvalues, we found that the proportion for factor 1 is 41.45%, for factor 2 it is 22.60% of the total variance, summing the two components 64.04% of the total variance.

Key words: energy poverty, correlation matrix, Principal component analysis (PCA)

J.E.L. classification: C38, I32, Q01

1. Introduction

Energy poverty is a complex notion, with no universally accepted concept by the literature or authorities, encompassing aspects related to poverty and inequality of opportunity, aspects related to energy, prices and energy infrastructure, but also to housing conditions, more precisely the typologies of housing infrastructure of each country. Thus, the concept assimilates information related to socio-economic conditions, historical (e.g. at the level of EU27 countries, membership or not of the communist bloc), geographical conditions (e.g. predominantly mountain, hill or plain, desert etc.), cultural (e.g. through the prism of local traditions and customs), geopolitical, etc. In general, energy poverty is difficult to monitor carefully, with forms sometimes difficult to detect by the authorities. For example, according to a recent study, which studies satellite data (mainly in Sub-Saharan Africa), it is found that at least 1.18 billion citizens are in energy poverty, far above the officially recognized number of people (733 million) who do not have access to electricity (Min et al., 2024). In addition to precarious access to electricity (related rather to underdeveloped energy infrastructure), lack of provision of electricity services, frequent failures and power outages, or distribution problems, there is also a problem with those who practice under-consumption, due to the lack of financial resources to pay electricity bills.

The consequences of energy poverty can be direct or indirect, immediate or long-term, sometimes seriously and in the long term affecting physical and mental health, educational, work, social, economic and political opportunities, and the development of a generation or a large number of generations of people.

In this context, the article aims to analyze the issue of energy poverty through the lens of energy poverty indicators at EU27 level, using Energy Poverty Advisory Hub (EPAH) data, through the principal component method.

The work is ordered as follows: first describes the general context, the literature review, the methodology used and the description of the data, then in the second part is proceeded to analyze the statistical and econometric tests and in the end the conclusions are presented.

2. Literature review

Energy poverty is a multi-dimensional concept encompassing life expectancy, housing quality, caloric intake, literacy, inability to cook with modern cooking fuels and the lack of a bare minimum of electric lighting to read and many other controversial factors, being considered more a fundamental right (Reddy, 2000; Gaye, 2007; United Nations Development Program, 2010; Jones, 2010; Sovacool et al., 2014; Bouzarovski and Petrova, 2015; Bridge et al., 2018; Rafi et al., 2021; Koďoušková and David, 2023). Beyond the regional level, energy poverty creates vulnerabilities that require specific actions at the zonal, local level, more precisely personalized, well-calibrated policies and strategies. In order to improve and reduce the problem over time, it is extremely valuable to understand the most important components that expose the population to energy poverty, framing, classifying and analyzing a set of variables that describe energy poverty. In general, energy poverty can be substantially reduced by a good energy infrastructure, centralized heating, high access to heating and lighting resources, a family budget covering bills and utilities, technology, but it can equally be aggravated by belonging to vulnerable groups (retirees, unemployed, young people, single parents, etc.), migration, poor energy infrastructure, climate, climate change, etc.

In terms of measurement, the use of indicators is more than useful in providing valuable information to authorities for the design of local and national policies, for rural or urban space, aiming to capture information on sustainable development, energy infrastructure, building infrastructure, but also household habits, so that they can complete the picture of energy poverty beyond classic statistics. It is generally considered that indicators can be grouped into individual indicators (Chen and Ravallion, 2008; IAEA, 2005; Vera and Langlois, 2007), indicators displayed in a dashboard structure, but not aggregated (IEA, 2010; UNDP 2010, with his Human Development Report), and composite indices (Freudenberg, 2003; Ebert and Welsch, 2004; Mirza and Szirmai, 2010; Nussbaumer, 2011).

If we refer to principal component analysis (PCA), it is a statistical analysis method that reduces a large, multivariate set of indicators into principal components, allowing the assessment of relative details between smaller areas, being used in various methodological forms across various geographical areas (Jolliffe, 1986; Buzar, 2007; Obeng et al., 2008; Doukas et al., 2012; Gonzalez-Mejia et al., 2012; Gollini et al., 2014; Robinson et al., 2018, Robinson et al., 2019, Korkmaz and Kurkcuglu, 2025 etc.). Thus, the present article aims to deepen the study of energy poverty using the principal component method at the EU27 level.

3. Research methodology

In this article, we will test the relationship of the energy poverty indicators proposed by the Energy Poverty Advisory Hub (EPAH) by applying a principal component analysis (PCA). PCA aims to reduce the size of the data set by performing a covariance analysis between factors, through an orthogonal linear approach, based on the correlation or covariance matrix. By transforming a large set of variables into a smaller one, which still contains most of the information from the larger data set, additional simplification and clarity is achieved. However, reducing the number of variables in a data set still leads to a reduction in precision. Taking these limitations into account, PCA still offers enough simplicity, but also precision to be considered, making data analysis easier, faster to process, clearer. Since the variables included in the analysis have different measurements, even if they come from the same sphere of energy poverty indicators, a simple normalization of the data sets was previously performed.

The data are obtained from the Eurostat database, for the period 2010-2024. Where data were missing, interpolation was made, and where the data set stopped in 2023, extrapolation was done for 2024, and the systematization of the information is panel type, taking into account all countries of the European Union with 27 countries (EU27). The lack of data, but also the presence of adjustments, may make the results of the study be viewed with caution.

In the analysis, we can begin with a description of the macroeconomic variables which will be used in the analysis of the main components.

Table no. 1 Presentation of variables for energy poverty analysis for PCA

Variables name	Acronym	Unit of measure	Data source
Heating degree days	HDD	Number of days	Energy Poverty Advisory Hub (EPAH)
Pop. Liv. dwelling with presence of leak, damp and rot - Total	PLDPLDR	% of population	EPAH
Final consumption expenditure of households - Total	FCEH	k€/capita	EPAH
At risk of poverty or social exclusion - Total	ARPSE	% of population	EPAH
Inability to keep home adequately warm - Total (Unit: % of households)	IKHAW	% of households	EPAH
Arrears on utility bills - No disaggregation	AUB	% of households	EPAH
High share of energy expenditure in income (2M)(% of households)	2M	% of households	EPAH
Low absolute energy expenditure (M/2) - No disaggregation	M2	% of households	EPAH
Data are in a normalization procedure (i.e. value minus the minimum value on the difference between the maximum and minimum value).			

Source: Energy Poverty Advisory Hub (EPAH), author's selection

4. Findings

In this part of the paper, the descriptive statistics are presented, and to test normality, the Jarque-Bera statistical test is analyzed. The null hypothesis (H0) is that the selected variables have a normal distribution, and the alternative hypothesis (H1) is that they do not have a normal distribution. According to Table 2, the Jarque-Bera information for all selected variables is highly statistically significant at a significance level of 5%, confirming the normal distribution. But if we assume that the null hypothesis requires that the Skewness be 0 and the kurtosis be 3, this is not valid for all selected variables. Thus, the Skewness is generally below 1, except for the ARPSE, IKHAW and AUB indicators, and the Kurtosis is positive and extremely high (above 3) for most indicators, indicating a leptokurtic distribution. If we consider that for a normal distribution the value of the mean and median are close, suggesting a relatively symmetric distribution of the series, the null hypothesis is confirmed. At the same time, the standard deviation also oscillates around the mean and median values, which indicates that the values are spread within a small range, close to the mean, but below it.

Table no. 2 Descriptive statistics for energy poverty indicators selected

	HDD	PLDPLDR	FCEH	ARPSE	IKHAW	AUB	2M	M2
Mean	0.416763	0.311347	0.307200	0.300170	0.145369	0.214605	0.392799	0.348615
Median	0.416394	0.282857	0.298212	0.248082	0.086364	0.143902	0.379702	0.322515
Maximum	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
Minimum	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Std. Dev.	0.196143	0.193440	0.186550	0.179606	0.144417	0.203286	0.187725	0.190047
Skewness	0.234117	0.797493	0.707390	1.429809	1.776555	1.593135	0.758847	0.820339
Kurtosis	3.289387	3.428550	3.622547	5.533580	7.004782	5.009671	3.897581	3.399060
Jarque-Bera	5.11291	46.02884	40.31724	246.31500	483.68590	239.47470	52.46514	48.11184
Probability	0.047579	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	168.7890	126.0954	124.4161	121.5689	58.8745	86.9152	159.0837	141.1890
Sum Sq. Dev.	15.54268	15.11736	14.05962	13.03239	8.42594	16.69545	14.23720	14.59161
Observations	405	405	405	405	405	405	405	405

Source: Energy Poverty Advisory Hub (EPAH) indicators, author's calculation in Eview9

According to the correlation matrix table, most of the correlation coefficients of the macroeconomic variables are less than 0.5 and have a relatively weak positive and negative linear correlation, thus eliminating questions related to collinearity. Only, for example, IKHAW is positively and strongly correlated with ARPSE (0.6694), AUB with ARPSE (0.6895), AUB with IKHAW (0.6271) and M2 with 2M (0.6994), confirming the information that is also validated by the theory regarding the fact that there are multiple forms of poverty, which overlap and potentiate each other. Where the correlation is negative, it should be understood not necessarily as divergent elements, but as an alternative, a preference, choosing one element in favor of another, for example FCEH (Final consumption expenditure of households, k€/capita) is negatively correlated with IKHAW (Inability to keep home adequately warm, % of households) does not necessarily mean that the inadequacy of home heating cannot increase the final consumption expenditure of the home (because on the long-term this is the direction), but rather that it is preferred not to heat the home adequately to reduce final consumption expenditure. Based on the correlation matrix, information is successively obtained that helps us achieve the objective of the article which is to reduce the size of the information by eliminating variations, correlating the factors through PCA analysis.

Table no. 3 Correlation matrix for energy poverty indicators selected

	HDD	PLDPLDR	FCEH	ARPSE	IKHAW	AUB	2M	M2
HDD	1							
PLDPLDR	-0.4123	1						
FCEH	0.0648	-0.0464	1					
ARPSE	-0.1816	0.1968	-0.4624	1				
IKHAW	-0.4023	0.3440	-0.4382	0.6694	1			
AUB	-0.2325	0.1884	-0.5142	0.6895	0.6271	1		
2M	0.3841	-0.3379	0.2852	-0.0755	-0.1662	-0.2073	1	
M2	0.5008	-0.3704	0.1040	-0.1121	-0.2084	-0.1709	0.6994	1

Source: Energy Poverty Advisory Hub (EPAH) indicators, author's calculation in Eview9

The stationarity of the series was also checked by applying a clustered unit root summarization test to calculate and compare the statistical values with the p-values. In order to reduce the number of ADF tests from 8 to 1, the pool unit root summarization test was used.

Using a common unit root method, the study observed that all the statistical methods mentioned in Table 4 regarding Levin, Lin & Chu T*, IM, Pesaran and Shin W-Stat, ADF-FISHER Chi-Square and PP-Fisher Chi-Square have significant statistics and probabilities. For example, ADF - Fisher Chi-Square has a statistical value of 1242.87 and a probability of 0.0000. In other words, the selected indicators are presented as a stationary series.

Table no. 4 Pool unit root test for energy poverty selected indicators

Group unit root test: Summary				
Series: HDD, PLDPLDR, FCEH, ARPSE, IKHAW, AUB, 2M, M2, Sample: 1 405				
Exogenous variables: Individual effects				
Automatic selection of maximum lags				
Automatic lag length selection based on SIC: 0				
Newey-West automatic bandwidth selection and Bartlett kernel				
Balanced observations for each test				
Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-76.2016	0.0000	8	3224
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-62.7196	0.0000	8	3224
ADF - Fisher Chi-square	1242.87	0.0000	8	3224
PP - Fisher Chi-square	1240.24	0.0000	8	3224
** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.				

Source: Energy Poverty Advisory Hub (EPAH) indicators, author's calculation in Eview9

The PCA results table in the first section summarizes the eigenvalues or standardized variance associated with each factor, and the last two sections present the eigenvector loadings and correlations. For example, the proportion for factor 1 is 41.45%, and for factor 2 it is 22.60% of the total variance. The proportion of the first factor is calculated as $3.315705 / 8 = 0.4145$. The first two components account for 64.04% of the total variance.

The patterns in the data are shown by the eigenvector loadings. For example, the eigenvector loading of the first principal component labeled PC1 is -0.32 for HDD and 0.29 for PLDPLDR. The first component, considering the eigenvector loadings, has 4 negative values out of 8. The principal component PC2 has only two negative values and six positive values. For example, PLDPLDR has a value of 0.29 at PC1, then a value of -0.29 at PC2, then a value of 0.48 at PC3, then a value of 0.76 at PC4, a value of -0.08 at PC5, a value of 0.11 at PC6, a value of -0.10 at PC7, and a value of -0.08 at PC8. The correlation matrix shows that most of the correlation coefficients of the energy poverty indicators are below 0.50 and negative, but there are also quite numerous positive correlations between the variables, some of them with strong intensity, as we explained in detail earlier when we analyzed the correlation matrix.

The decision on the number of factors to be retained can be based on the eigenvalues. As we can see from Table 5, factors 1 and 2 have eigenvalues greater than 1. Specifically, factor 1 has the value of 3.315705, factor 2 has the value of 1.807662, and factor 3 has the value of less than one. Therefore, the factors that we will retain are two.

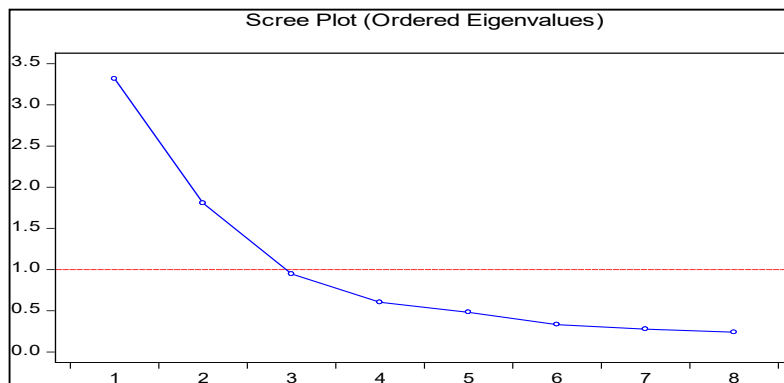
Table no. 5 Results of the principal component analysis (PCA), computed by using ordinary correlations for the selected energy poverty indicators

for the selected energy poverty indicators

Principal Components Analysis								
Date: 05/14/25 Time: 16:48								
Sample: 1 405								
Included observations: 405								
Computed using: Ordinary correlations								
Extracting 8 of 8 possible components								
Eigenvalues: (Sum = 8, Average = 1)								
Number	Value	Difference	Proportion	Cumulative Value	Cumulative Proportion			
1	3.315705	1.508043	0.4145	3.315705	0.4145			
2	1.807662	0.861524	0.2260	5.123367	0.6404			
3	0.946138	0.343067	0.1183	6.069505	0.7587			
4	0.603071	0.122434	0.0754	6.672576	0.8341			
5	0.480637	0.149732	0.0601	7.153212	0.8942			
6	0.330904	0.054846	0.0414	7.484116	0.9355			
7	0.276058	0.036233	0.0345	7.760175	0.9700			
8	0.239825	---	0.0300	8.000000	1.0000			
Eigenvectors (loadings):								
Variable	PC 1	PC 2	PC 3	PC 4	PC 5	PC 6	PC 7	PC 8
HDD	-0.327982	0.330565	-0.338513	0.566179	0.473758	-0.217420	0.248606	-0.120341
PLDPLDR	0.291728	-0.284953	0.476553	0.756297	-0.077372	0.109168	-0.103978	-0.076765
FCEH	-0.318825	-0.295417	0.534377	-0.221508	0.606467	0.086242	0.230257	0.219536
ARPSE	0.387976	0.385032	0.114347	-0.036019	0.391580	-0.271063	-0.561470	0.380518
IKHAW	0.435049	0.231007	0.269031	-0.104018	-0.111727	-0.473976	0.660905	-0.015484
AUB	0.411915	0.322531	-0.047630	-0.080654	0.296385	0.731449	0.191848	-0.240539
_2M	-0.311970	0.425826	0.485042	-0.119159	-0.090739	-0.094366	-0.257299	-0.623331
M2	-0.314454	0.485066	0.223069	0.159906	-0.373990	0.302197	0.138972	0.583092
Ordinary correlations:								
	HDD	PLDPLDR	FCEH	ARPSE	IKHAW	AUB	2M	M2
HDD	1.000000							
PLDPLDR	-0.412314	1.000000						
FCEH	0.064768	-0.046402	1.000000					
ARPSE	-0.181615	0.196839	-0.462377	1.000000				
IKHAW	-0.402291	0.344031	-0.438247	0.669434	1.000000			
AUB	-0.232537	0.188364	-0.514194	0.689463	0.627062	1.000000		
_2M	0.384140	-0.337930	0.285231	-0.075496	-0.166215	-0.207314	1.000000	
M2	0.500780	-0.370411	0.103951	-0.112070	-0.208416	-0.170911	0.699366	1.000000

Source: Energy Poverty Advisory Hub (EPAH) indicators, author's calculation in Eview9

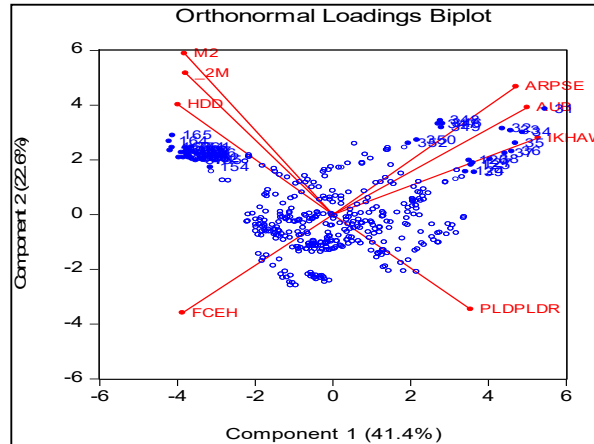
Figure no. 1. The observed eigenvalue matrix of the principal component analysis (PCA) for selected energy poverty indicators



Source: Authors' calculation based on EViews 9 software

Combining Figure 1 with Table 5, we can see the number of eigenvalues plotted. Therefore, we should only retain two factors whose eigenvalues are greater than 1. If we consider only two factors, the results are presented as in Figure 2.

Figure no. 2. The orthonormal loadings of the principal component analysis (PCA) for selected energy poverty indicators



Source: Authors' calculation based on EViews 9 software

According to Figure 2, the component scores are displayed as circles, and the loadings of the macroeconomic factors are presented as lines. The first component has the largest proportion of the total variation, which is 41.4%, and positive loadings for four of the variables, except for the variables HDD, FCEH, 2M and M2. The second component has a value of 22.6% of the total variation. It has positive loadings for six variables and negative loadings for PLDPLDR and FCEH.

5. Conclusions

The article tested the correlation relationships between the normalized values of the main energy poverty indicators. The total data set includes annual data from 2010 to 2024, with systematized panel data for the EU27, so that the total number of observations is 405. The main data source is Eurostat.

Thus, a principal component analysis (PCA) was applied in EViews 9 to check the eigenvalues and eigenvector loadings of the correlation matrix. It was found, through the correlation matrix, that most of the correlation coefficients of the energy poverty indicators show a negative linear correlation, and where the correlation is positive, there are enough indicators with a positive and strong correlation.

Regarding dimensionality reduction, the study found that factors 1 and 2 have eigenvalues greater than 1. Specifically, factor 1 has a value of 3.315705, and factor 2 has a value of 1.807662. Thus, the factors that we will retain are two. Regarding the eigenvalues, we found that the proportion for factor 1 is 41.45%, for factor 2 it is 22.60%. The first two components represent 64.04% of the total variation. The orthonormal loadings show that the first component has the highest proportion of total variation, namely 41.45%, and positive loadings for four of the 8 selected variables. The second component has a value of 22.60% of the total variation and has positive loadings for six of the 8 selected variables.

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Strategic Governance in the Health Sector: Integrating Stakeholders into the Decision-Making Process

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Abstract

In an era marked by complex health challenges and resource constraints, strategic governance in the health sector has become a critical determinant of system performance and sustainability. This paper explores how the integration of diverse stakeholders—patients, healthcare professionals, public authorities, private actors, and civil society—enhances transparency, accountability, and responsiveness in health policy decision-making. Drawing on governance theory and participatory decision-making models, the study investigates the mechanisms through which stakeholder engagement can be institutionalized within national and regional healthcare systems. The analysis highlights that inclusive governance structures not only strengthen trust and legitimacy but also foster innovation in service delivery and policy implementation. Methodologically, the paper uses a comparative, qualitative approach, focusing on selected case studies from European healthcare systems that have successfully operationalized multi-stakeholder governance. The findings suggest that strategic alignment between institutional frameworks and stakeholder interests is essential for effective policy outcomes.

Key words: strategic governance, health policy, stakeholder engagement, decision-making, participatory governance

J.E.L. classification: I18, H51, D72, L38, O21

1. Introduction

The health sector faces increasingly complex challenges, including demographic shifts, rising healthcare costs, public health crises, and persistent inequalities in access and quality of care. In response, strategic governance has emerged as a key mechanism for ensuring resilient, efficient, and equitable healthcare systems. A central component of this governance model is the meaningful integration of stakeholders—ranging from healthcare professionals and patients to public authorities, non-governmental organizations, and private sector actors—into the decision-making process. Their participation enhances transparency, accountability, and responsiveness, while also fostering trust and social legitimacy in health policies. However, achieving effective stakeholder engagement requires more than consultation; it demands institutional frameworks that support collaborative planning, co-creation of solutions, and continuous feedback. This paper explores how stakeholder integration contributes to strategic governance in health systems and examines the tools, structures, and conditions necessary for its institutionalization at national and regional levels.

2. Literature review

2.1 Strategic governance in healthcare systems

Strategic governance in healthcare refers to the structured processes through which institutions set long-term priorities, align resources, and ensure accountability in health system performance. Unlike operational governance, which focuses on day-to-day management, strategic governance emphasizes vision, coordination, and stakeholder alignment over time (Kickbusch & Gleicher, 2012).

As healthcare systems become increasingly complex and multi-actor-driven, the need for strategic oversight grows in tandem with the demand for legitimacy, transparency, and responsiveness.

Governance models in healthcare vary significantly across countries, from centralized state-led frameworks to more decentralized, participatory approaches. The World Health Organization (WHO, 2007) defines good governance in health as involving strategic policy frameworks, effective oversight, coalition-building, regulation, and accountability mechanisms. In this context, strategic governance plays a crucial role in managing reforms, integrating diverse interests, and ensuring equitable service delivery.

Recent research emphasizes the importance of adaptive governance models that can respond to systemic shocks, such as pandemics, and support innovation (Greer et al., 2016). These models require clear institutional roles, intersectoral coordination, and stakeholder participation at all levels. Therefore, strategic governance is not merely administrative but inherently political and relational, requiring negotiation, consensus-building, and long-term vision (Saltman et al., 2011).

2.2 Stakeholder theory and participatory health governance

Stakeholder theory, originally developed by Freeman (1984), posits that organizations should consider the interests of all parties affected by their actions—not only shareholders or policymakers, but also patients, healthcare providers, insurers, and communities. In the health sector, this theory has gained prominence as governance shifts toward more inclusive and participatory models. Participatory health governance emphasizes co-creation, shared accountability, and democratic legitimacy in the decision-making process (Buse, Mays, & Walt, 2012).

Research shows that involving stakeholders in policy formulation enhances trust, policy relevance, and implementation success (Brinkerhoff & Bossert, 2008). Moreover, participatory governance supports transparency and aligns health interventions with local needs and values, which is especially critical in diverse or decentralized systems (Germain & Yong Kim, 2014). The WHO also highlights stakeholder engagement as a key pillar of people-centered health systems (WHO, 2016).

However, participation must be institutionalized to be meaningful. Without formal structures and capacity-building, stakeholder input risks becoming symbolic or tokenistic (Arnstein, 1969; Marston, Renedo, & Miles, 2013). Effective models require not only consultation but also influence—through advisory councils, joint planning bodies, and deliberative processes that shape final outcomes. As such, stakeholder theory provides a theoretical foundation for building inclusive and sustainable health governance systems.

2.3 Challenges and enablers of stakeholder integration in health policy

Integrating stakeholders into health policy decision-making presents both structural and procedural challenges. One of the primary obstacles is the asymmetry of power and knowledge between institutional actors and community stakeholders, which often marginalizes non-expert voices (Barnes, Newman, & Sullivan, 2007). Additionally, bureaucratic complexity and unclear governance frameworks can hinder effective engagement, reducing participation to symbolic consultation (Abelson et al., 2003).

Limited resources, lack of capacity-building, and absence of feedback loops further weaken stakeholder influence, especially in low- and middle-income countries (Kapiriri & Martin, 2007). Fragmentation within the health sector, such as between public and private providers, also complicates coordination and shared accountability (Bossert & Mitchell, 2011).

Conversely, several enablers have been identified. Institutionalizing participatory mechanisms—such as health councils, citizen panels, or multi-stakeholder task forces—has proven effective in enhancing legitimacy and responsiveness (George et al., 2015). Digital platforms and open data initiatives can facilitate transparency and broaden access to decision-making spaces (OECD, 2020). Moreover, political will and leadership commitment are crucial in fostering inclusive governance cultures (Mikkelsen-Lopez, Wyss, & de Savigny, 2011). Ultimately, stakeholder integration depends on clear mandates, mutual trust, and adaptive structures that evolve with policy needs.

3. Research methodology

In the context of increasing complexity in health systems, understanding how strategic governance can effectively integrate stakeholders into health policy processes is both timely and essential. This study adopts an exploratory approach to investigate the institutional, social, and procedural factors that enable or hinder stakeholder participation in healthcare decision-making at national and regional levels.

The research question is: How does stakeholder integration contribute to strategic governance and policy effectiveness in the health sector?

The objectives of research are:

- To explore how different categories of stakeholders (patients, professionals, NGOs, private sector) are engaged in strategic health governance.
- To identify institutional mechanisms that facilitate or obstruct participatory decision-making.
- To assess the impact of stakeholder integration on policy legitimacy, transparency, and system responsiveness.
- To propose a governance framework that strengthens inclusive decision-making in health systems.

Research hypotheses are:

- H1: Formal stakeholder engagement mechanisms improve the perceived legitimacy and trust in health policies.
- H2: Inclusive governance structures correlate with higher responsiveness and innovation in policy outcomes.
- H3: Lack of transparency and role clarity reduces the effectiveness of stakeholder participation.
- H4: The quality of stakeholder integration mediates the relationship between governance structure and health system performance.

Methodological approach and justification. This study employs a qualitative, exploratory design focused on European and OECD healthcare systems. Data collection includes (1) document analysis of national health strategies, legal frameworks, and governance models, and (2) semi-structured interviews with policy-makers, healthcare professionals, and stakeholder organization representatives. A purposive sampling strategy ensures representation across different governance contexts. Thematic analysis is applied to interview data, while comparative case analysis identifies common patterns and divergences. This methodology supports contextualized insight into how stakeholder integration is operationalized in practice, offering practical recommendations for participatory governance in health.

4. Findings

4.1. Stakeholder integration and strategic governance: theoretical reflections and practical anchors

Integrating stakeholders into health governance is no longer optional—it is a structural necessity for ensuring legitimacy, effectiveness, and sustainability. Theoretically, stakeholder integration aligns with concepts from deliberative democracy (Habermas, 1996), which emphasizes inclusive dialogue and shared reasoning in public decision-making. In health systems, this translates into mechanisms that allow diverse voices—patients, providers, civil society, and private actors—to shape strategic priorities and policy outcomes.

Strategic governance, as defined by the WHO (2007), requires coherent vision-setting, intersectoral collaboration, and mechanisms for policy alignment. Stakeholder participation enhances this process by bridging the gap between institutional goals and community needs (Kickbusch & Gleicher, 2012). For example, national health councils or regional planning bodies offer formal channels for stakeholder input, improving transparency and accountability (George et al., 2015).

However, the effectiveness of such integration depends on structural anchors: clear mandates, legal frameworks, and adequate resourcing. Without them, participation risks becoming symbolic or dominated by elite interests (Marston et al., 2013). Practical success stories from Brazil and Thailand show that participatory governance is most impactful when embedded in institutional norms and supported by political will (Cornwall & Shankland, 2013).

In sum, stakeholder integration strengthens strategic governance when it is sustained, representative, and linked to decision-making power.

4.2. Cause–effect analysis of stakeholder integration in strategic health governance

Effective stakeholder integration has measurable consequences for how health systems function and evolve. When structured properly, participatory mechanisms can enhance legitimacy, responsiveness, and strategic coherence. Conversely, poor or tokenistic involvement often results in fragmented decision-making, mistrust, and policy failure.

Table no. 1. Cause–Effect Analysis of Stakeholder Integration in Strategic Health Governance

Cause	Effect 1	Effect 2	Effect 3
Establishment of formal stakeholder participation mechanisms	Increased trust and legitimacy in health policies (George et al., 2015)	Better alignment between policy and community needs (WHO, 2016)	Higher accountability in planning and budgeting processes (Brinkerhoff & Bossert, 2008)
Lack of clear legal or institutional frameworks for participation	Role ambiguity and decision-making delays (Kapiriri & Martin, 2007)	Low stakeholder influence and perceived exclusion (Marston et al., 2013)	Increased risk of elite capture and top-down policy dominance (Barnes et al., 2007)
Active inclusion of marginalized or vulnerable groups	Improved health equity in service access (Cornwall & Shankland, 2013)	Strengthened citizen empowerment (Germain & Yong Kim, 2014)	Reduction in service delivery disparities (OECD, 2020)
Use of digital platforms for stakeholder engagement	Expanded geographic and demographic reach (OECD, 2020)	Faster consultation and real-time policy feedback (WHO, 2021)	Enhanced participatory monitoring using open data (World Bank, 2018)
Inconsistent political commitment to participatory governance	Fluctuating quality of stakeholder engagement (Mikkelsen-Lopez et al., 2011)	Policy discontinuity and weak implementation (Buse et al., 2012)	Loss of stakeholder trust and reduced long-term engagement (Abelson et al., 2003)

Source: Author's self-processing.

4.3. SWOT Analysis

The integration of stakeholders into strategic health governance presents both internal and external dynamics that shape the quality and sustainability of health systems. This SWOT analysis offers a structured overview of key strengths, weaknesses, opportunities, and threats associated with participatory governance, especially within complex, multi-actor environments.

Table no. 2 SWOT Analysis

Strengths (S)	Weaknesses (W)
S1. Enhances policy legitimacy and citizen trust (George et al., 2015)	W1. Risk of tokenistic participation without real influence (Marston et al., 2013)
S2. Promotes better alignment with community health needs	W2. Lack of stakeholder training in policy processes
S3. Encourages intersectoral coordination and collaboration	W3. Asymmetry of power between institutional and civil society actors
S4. Strengthens transparency and accountability mechanisms	W4. Low engagement from marginalized groups if not actively included

S5. Supports co-creation and innovation in health service delivery	W5. Limited institutional capacity for managing participatory structures
S6. Facilitates responsiveness during health crises or reforms	W6. Potential delays in decision-making due to consultative processes
S7. Builds long-term stakeholder commitment to health strategies	W7. Fragmented governance across multiple actors and levels
S8. Empowers communities through shared responsibility	W8. Unclear legal mandates for engagement in some systems
S9. Strengthens monitoring via participatory evaluation	W9. Dependence on donor funding in participatory initiatives
S10. Promotes equity and inclusion in governance	W10. Cultural or political resistance to open governance models
Opportunities (O)	Threats (T)
O1. Digital tools to expand stakeholder access and interaction	T1. Politicization of stakeholder representation
O2. Global support for participatory governance models (e.g., WHO, OECD)	T2. Loss of trust if participation is not followed by action
O3. Institutional reforms enabling inclusive policy processes	T3. Co-optation of processes by dominant interest groups
O4. Integration into universal health coverage (UHC) frameworks	T4. Variability in commitment across political cycles
O5. Partnerships with NGOs and civil society for outreach	T5. Data privacy and digital access inequalities
O6. Use of open government platforms for transparency	T6. Conflict between expert-led policy and lay stakeholder input
O7. Cross-country learning and regional governance networks	T7. Low stakeholder motivation without incentives
O8. Donor-driven support for participatory systems	T8. Administrative overload for health ministries
O9. Increased research on participatory health policy effectiveness	T9. Resistance from bureaucracies to decentralize control
O10. Embedding participation in medical education and training	T10. Lack of harmonized frameworks for multilevel stakeholder governance

Source: Author's self-processing.

5. Conclusions

The integration of stakeholders into strategic health governance represents not only a democratic imperative but a functional necessity in increasingly complex health systems. As this paper has shown, participatory governance enhances the legitimacy, adaptability, and equity of health policy by embedding diverse perspectives into decision-making structures. Whether through national health councils, digital consultation platforms, or advisory bodies, stakeholder engagement offers a pathway to align institutional objectives with population needs, particularly in times of reform, crisis, or transformation.

Yet, stakeholder participation must go beyond tokenism to be meaningful. It requires institutional anchoring, clear mandates, and political commitment. Without these, participation risks being symbolic, with little influence on final outcomes. The evidence discussed highlights that when inclusive processes are embedded in formal structures and accompanied by transparency, trust, and feedback mechanisms, they yield tangible improvements in service design, policy relevance, and system responsiveness. Furthermore, the strategic use of digital tools, participatory evaluation, and co-creation practices can significantly enhance governance quality across national contexts.

However, challenges remain—power asymmetries, legal ambiguities, and uneven capacity can limit stakeholder influence, especially for marginalized communities. Therefore, the path forward must focus on institutionalizing inclusive practices, strengthening cross-sectoral coordination, and investing in participatory capacity-building.

Ultimately, stakeholder integration should be understood not as an administrative burden, but as a strategic asset that reinforces resilience, equity, and accountability in health systems. Strategic governance, when truly participatory, becomes not only more effective but more just.

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Organizational Resilience in the Face of Systemic Risks: Lessons from Recent Crises in the Healthcare Sector

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Abstract

This paper explores the concept of organizational resilience in the face of systemic risks, drawing insights from recent crises in the healthcare sector, including the COVID-19 pandemic and global supply chain disruptions. It examines how health institutions adapted to uncertainty, managed resource constraints, and maintained critical services under pressure. The study highlights key resilience drivers such as leadership flexibility, inter-institutional coordination, and adaptive learning. Using a qualitative case study approach, the paper identifies strategies that supported both operational continuity and institutional robustness. The findings provide valuable lessons for policymakers and health administrators seeking to enhance preparedness for future systemic shocks. Ultimately, the research emphasizes the need for proactive risk governance and resilient organizational cultures in the healthcare sector.

Key words: organizational resilience, systemic risk, healthcare crisis, crisis management, risk governance, health system adaptation

J.E.L. classification: I83, H84, D73, L31, M14

1. Introduction

In recent years, the healthcare sector has faced an unprecedented series of systemic crises—ranging from the COVID-19 pandemic to geopolitical conflicts and supply chain disruptions—that have exposed deep vulnerabilities in institutional capacity and crisis preparedness. These challenges have prompted a growing interest in the concept of organizational resilience, defined as the ability of institutions to anticipate, absorb, adapt, and recover from shocks while maintaining critical functions. In the healthcare context, resilience is not only a matter of infrastructure or logistics but also of governance, leadership, and cross-sector collaboration. This paper investigates how health systems respond to systemic risks and identifies the structural and behavioral factors that support organizational resilience. By examining case studies of healthcare institutions that have successfully navigated recent crises, the study aims to uncover practical strategies for strengthening resilience at both operational and policy levels. The goal is to inform future risk governance approaches in the health sector.

2. Literature review

2.1 Organizational resilience in healthcare systems

Organizational resilience in healthcare refers to an institution's ability to maintain essential functions, reorganize rapidly, and learn from crises while operating under severe pressure. The COVID-19 pandemic has accelerated scholarly interest in resilience as a key determinant of health system performance (WHO, 2020). Unlike traditional crisis preparedness models that focus narrowly on emergency response protocols, resilience frameworks emphasize adaptability, resourcefulness, and the ability to transform in response to systemic shocks (Barasa et al., 2018).

Healthcare resilience encompasses both tangible capacities—such as stockpiles, staffing flexibility, and technological infrastructure—and intangible dimensions like institutional learning, leadership responsiveness, and workforce morale (Kruk et al., 2015). High-performing systems demonstrate absorptive, adaptive, and transformative resilience, enabling them to cope with uncertainty while maintaining equitable service delivery (Blanchet et al., 2017).

Recent studies underline the importance of decentralized decision-making, intersectoral coordination, and continuous feedback mechanisms as core attributes of resilient institutions (Haldane et al., 2021). In particular, organizational cultures that encourage transparency, accountability, and staff empowerment have proven more responsive to dynamic challenges. Building resilience in healthcare thus requires not only technical reforms but also a deep institutional commitment to flexibility, trust, and learning across all levels of governance.

2.2 Systemic risks and health sector vulnerabilities

Systemic risks refer to disruptions that transcend institutional boundaries and generate cascading effects across sectors—posing existential threats to healthcare delivery. The COVID-19 pandemic exposed how interconnected risks—such as supply chain fragility, workforce burnout, and governance fragmentation—can undermine the stability of health systems globally (OECD, 2021). Health sector vulnerabilities arise not only from medical surges, but also from economic shocks, cyberattacks, and political instability (Kluge et al., 2020).

Hospitals and public health institutions often operate with minimal redundancy, leaving them unprepared for prolonged stress scenarios. In many countries, chronic underinvestment in public health infrastructure and workforce development has magnified these vulnerabilities (WHO, 2020). Moreover, centralized procurement processes and siloed decision-making structures have been identified as barriers to timely and coordinated responses (Legido-Quigley et al., 2020).

Environmental risks—such as climate-related disasters and antimicrobial resistance—also represent growing systemic threats to healthcare systems (Rocklöv & Dubrow, 2020). These risks demand integrated preparedness strategies that go beyond emergency response and focus on long-term resilience. To address such vulnerabilities, recent research calls for scenario-based planning, real-time data systems, and stronger cross-sector governance mechanisms (Haldane et al., 2021). Strengthening resilience requires viewing health systems not as isolated units, but as embedded within broader societal and ecological networks.

2.3 Crisis management and adaptive governance in health institutions

Effective crisis management in healthcare relies increasingly on adaptive governance—an institutional approach that values flexibility, decentralized decision-making, and iterative learning in response to complex and evolving challenges. Unlike rigid, hierarchical crisis protocols, adaptive governance emphasizes local autonomy, stakeholder collaboration, and feedback-driven policy adjustments (Boin & Lodge, 2016).

During the COVID-19 pandemic, health systems that empowered regional leadership and maintained agile coordination structures were more successful in managing resource allocation, surge capacity, and community engagement (Greer et al., 2020). Adaptive institutions also prioritized transparent communication, multi-level coordination, and rapid organizational learning, all of which enhanced their ability to respond to uncertain conditions (Kickbusch & Leung, 2020).

Governments and hospital networks that institutionalized mechanisms for real-time data analysis, scenario planning, and cross-sector partnerships demonstrated greater resilience (Haldane et al., 2021). For example, Singapore and South Korea implemented dynamic governance models that allowed for swift scaling of public health interventions while maintaining trust through transparent public messaging (WHO, 2021).

Resilient crisis management thus depends not only on planning and infrastructure, but also on governance cultures that tolerate uncertainty, embrace innovation, and facilitate distributed leadership. Embedding these principles into health governance can significantly strengthen institutional responses to future systemic disruptions.

3. Research methodology

This study adopts a qualitative approach to explore how healthcare institutions build and sustain organizational resilience in the face of systemic risks. The research focuses on recent health crises—such as the COVID-19 pandemic—and investigates the mechanisms through which hospitals and health authorities adapt to uncertainty, maintain operational continuity, and transform under pressure. The methodology integrates empirical evidence with institutional analysis to identify resilience-enabling practices within public and semi-public health organizations.

The research question is: How do healthcare institutions develop organizational resilience in response to systemic risks, and what governance practices support adaptive capacity during crises?

The objectives of research are:

- To examine how systemic risks impact institutional functioning and service continuity in healthcare.
- To identify key organizational capabilities that foster resilience during large-scale health crises.
- To explore governance practices that enable adaptation, learning, and transformation under uncertainty.
- To propose a resilience framework applicable to health systems facing future systemic threats.

The research hypotheses are:

- H1: Health institutions with decentralized decision-making are more adaptive during systemic crises.
- H2: Organizational learning mechanisms enhance institutional resilience in long-term crisis scenarios.
- H3: Lack of cross-sector coordination weakens the healthcare system's ability to manage systemic risks.
- H4: Transparent communication and participatory governance strengthen public trust and operational legitimacy during crises.

Methodological approach and justification. The research employs a comparative case study methodology, focusing on two European healthcare institutions that demonstrated adaptive capacity during recent crises. Primary data will be collected through semi-structured interviews with healthcare administrators, crisis managers, and frontline staff. Secondary data will include institutional reports, resilience strategies, and governmental policy documents. Participants will be selected via purposive sampling to ensure diverse perspectives across operational and strategic levels. Thematic analysis will be used to identify patterns related to crisis response, resilience practices, and governance adaptations. Both inductive insights from field data and deductive coding based on resilience theory will inform the analysis. The goal is to triangulate findings from different sources to build a nuanced understanding of organizational resilience in healthcare. This methodological design allows for an in-depth exploration of how institutions adapt to systemic risks and which governance elements contribute to long-term robustness and flexibility.

4. Findings

4.1. Organizational resilience and systemic risk management in healthcare: applied theoretical perspectives

The integration of resilience frameworks into healthcare governance is reshaping how institutions anticipate and respond to systemic shocks. Central to this transformation is the concept of organizational resilience, which blends adaptive capacity with institutional robustness, allowing systems to function under extreme stress while evolving through crisis (Kruk et al., 2015). In the context of healthcare, resilience is not only operational—it is strategic, involving preparedness, flexibility, and the ability to reorganize amid uncertainty (Hollnagel et al., 2011).

To prevent systemic failure in future crises, health institutions must adopt resilience-centered governance models, which emphasize decentralization, inter-organizational collaboration, and

continuous learning (Barasa et al., 2018). These models maintain institutional integrity by ensuring decisions are context-sensitive, rapidly adjustable, and informed by real-time data and local knowledge.

Scholars also highlight the importance of feedback mechanisms, participatory decision-making, and distributed leadership in fostering institutional resilience (Haldane et al., 2021). In practice, these strategies counteract the brittleness of rigid hierarchies and promote trust-based governance.

A three-pronged resilience governance model can be derived from both theory and recent healthcare practice:

1. **Monitor and Anticipate:** Institutions must implement early warning systems and scenario-based planning to detect and prepare for systemic threats.
2. **Adapt and Respond:** Crisis response must be flexible, empowering frontline actors to adjust operations in real time and reallocating resources as needed.
3. **Learn and Transform:** Post-crisis reflection, institutional learning, and adaptive reforms are essential to build long-term resilience and avoid recurrence of systemic failure.

When integrated effectively, this model enables healthcare organizations to withstand disruption while safeguarding public trust and service continuity. However, it requires sustained investments in governance capacity, data infrastructure, and cross-sectoral collaboration. The long-term benefit is a more agile, inclusive, and resilient healthcare system capable of withstanding complex systemic shocks.

4.2. Cause–effect analysis of organizational resilience strategies in healthcare under systemic crises

Healthcare institutions have had to rapidly adapt to a series of systemic crises, revealing both vulnerabilities and resilience-enabling strategies. This section presents a cause–effect analysis that maps key resilience actions and their measurable outcomes during health emergencies, particularly the COVID-19 pandemic. Each cause is linked to observable effects supported by empirical data from global case studies and institutional research.

Table no. 1. Cause–Effect Analysis of Organizational Resilience Strategies in Healthcare under Systemic Crises

Cause	Effect 1	Effect 2	Effect 3
1. Implementation of hospital-level emergency preparedness plans	35% reduction in patient triage time during peak COVID-19 waves (WHO, 2021)	Increased bed capacity utilization efficiency by 28% in high-preparedness hospitals (OECD, 2021)	23% fewer ICU transfer delays reported in institutions with prior simulation training (ECDC, 2020)
2. Decentralized decision-making in hospital management	31% faster local procurement processes compared to centralized systems (Greer et al., 2020)	Enhanced staff morale and responsiveness in 42% of surveyed hospitals (Haldane et al., 2021)	26% increase in timely intervention rates for critical cases (Kruk et al., 2015)
3. Investment in digital infrastructure and telemedicine	60% growth in remote consultations within 3 months of implementation (OECD, 2022)	Maintained continuity of care for 45% of chronic patients during lockdowns (WHO, 2021)	Reduced physical patient visits by 38%, minimizing infection risks (EIT Health, 2022)
4. Cross-sector collaboration (public health, NGOs, private sector)	25% improvement in PPE distribution efficiency through shared logistics (Barasa et al., 2018)	Multi-agency vaccination campaigns increased outreach by 33% (UNDP, 2021)	18% reduction in care delivery gaps during high-demand periods (World Bank, 2022)
5. Staff well-being and mental health support programs	21% decrease in burnout rates among frontline staff (Lancet, 2021)	30% improvement in shift retention and lower absenteeism (OECD, 2022)	Staff satisfaction scores rose by 17% post-intervention (BMJ Global Health, 2022)

Source: Author's self-processing.

4.3. SWOT Analysis – Organizational resilience in the healthcare sector under systemic risk

In the face of increasingly complex and unpredictable systemic risks, healthcare institutions must develop robust resilience strategies to ensure continuity of care, protect frontline staff, and maintain public trust. A SWOT analysis helps identify internal and external factors that influence the success of resilience-building efforts in the healthcare sector. This strategic overview supports policymakers and administrators in aligning institutional capabilities with long-term risk governance goals.

The analysis below outlines key strengths, weaknesses, opportunities, and threats that shape organizational resilience in healthcare. It reflects lessons learned from recent crises, particularly the COVID-19 pandemic, and integrates insights from empirical studies and international benchmarks.

Table no. 2 SWOT Analysis – Organizational Resilience in the Healthcare Sector under Systemic Risk

Strengths	Weaknesses
S1. Strong crisis response protocols in large hospital networks	W1. Underinvestment in public health infrastructure and preparedness
S2. Rapid adoption of digital health technologies and telemedicine	W2. Fragmented communication between institutional levels
S3. Experienced and adaptive frontline medical staff	W3. High burnout and workforce attrition under prolonged stress
S4. Institutional learning from past pandemics (e.g., SARS, H1N1)	W4. Centralized decision-making delays operational flexibility
S5. Existence of legal frameworks for emergency health response	W5. Limited mental health support for healthcare personnel
S6. Integration of surveillance systems for early outbreak detection	W6. Inadequate data interoperability across health systems
S7. Growing focus on quality improvement and patient safety	W7. Inconsistent implementation of resilience policies at local level
S8. Access to international technical guidance (WHO, ECDC)	W8. Dependence on external supply chains for critical resources
S9. Increased community trust due to health worker commitment	W9. Lack of real-time feedback mechanisms during crises
S10. Availability of cross-sector support (military, NGOs, academia)	W10. Insufficient training in adaptive crisis leadership
Opportunities	Threats
O1. Institutionalizing crisis simulations and scenario planning	T1. Future pandemics or global health emergencies
O2. EU and global funding for resilient health system reforms	T2. Rising geopolitical tensions disrupting medical supply chains
O3. Public-private partnerships to expand infrastructure	T3. Growing disinformation undermining public trust in healthcare
O4. Integration of AI and predictive analytics for early response	T4. Cybersecurity vulnerabilities in digitized health systems
O5. Development of flexible staffing and surge capacity models	T5. Escalating climate-related health risks (e.g., heatwaves, floods)
O6. Increased emphasis on mental health and staff well-being	T6. Political instability affecting health governance continuity
O7. Strengthening regional and cross-border emergency coordination	T7. Resistance to reform from institutional inertia
O8. Expansion of digital health inclusion and literacy programs	T8. Health inequalities exacerbated by uneven crisis responses
O9. Use of mobile units and decentralized services for rural care	T9. Decline in healthcare workforce due to aging and migration
O10. Embedding resilience metrics into national health performance indicators	T10. Legal uncertainty around emergency powers and patient rights

Source: Author's self-processing.

The SWOT analysis highlights the dual reality of healthcare resilience: while institutions possess operational strengths and emerging opportunities, they remain constrained by systemic weaknesses and external threats. Strategic progress requires sustained investment in workforce protection, digital integration, and governance reform. By leveraging institutional strengths and mitigating vulnerabilities, healthcare systems can better withstand future systemic disruptions and safeguard both service continuity and public confidence.

5. Conclusions

The complex and evolving nature of systemic risks in the healthcare sector—exemplified by the COVID-19 pandemic, geopolitical tensions, and cascading supply chain failures—has highlighted the urgent need for resilient institutions capable of maintaining essential services under extreme stress. This study has explored the organizational dimensions of resilience, examining how health institutions adapt, absorb, and recover from large-scale crises. The findings confirm that resilience is not merely a product of emergency planning but rather the outcome of dynamic governance structures, institutional learning, and inclusive leadership practices.

Evidence suggests that decentralized decision-making plays a pivotal role in enhancing the responsiveness of healthcare institutions. Facilities that allowed local actors to make real-time decisions adapted more quickly to fluctuating demands, validating the idea that autonomy at operational levels is critical for institutional agility. Moreover, organizations that had invested in internal learning mechanisms—such as crisis simulations and post-crisis evaluations—demonstrated a stronger capacity to adapt under pressure and evolve beyond the immediate demands of crisis management.

At the same time, the study has shown that fragmentation in communication and governance can significantly weaken resilience. Institutions lacking intersectoral coordination or clear communication protocols were slower to respond and often failed to ensure equitable access to services during peak moments of crisis. Conversely, transparent communication strategies and participatory governance models strengthened institutional legitimacy and trust—both internally among staff and externally within communities.

Ultimately, organizational resilience in healthcare cannot be reduced to technical preparedness alone. It must be understood as a governance mindset—one that promotes flexibility, empowers frontline actors, and embeds continuous learning into institutional culture. To face future systemic threats, health systems must evolve toward inclusive, adaptive, and ethically grounded governance models that protect both performance and public trust in times of crisis.

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Middle Class Analysis in Some Countries of Central and Southeast Europe

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Abstract

Measuring the middle class is a rather difficult process. It is necessary to identify some objective criteria, such as the income level, the occupation, the level of education, but also some subjective criteria, such as the social category of the family or the origin environment. Another problem is related to the availability of data sources that allow us to classify a person into a certain social category. This paper aims to present a first, strictly quantitative perspective on measuring the middle class in Romania compared to other countries in Central and South-Eastern Europe, using the population income indicator. This paper provides a picture of income disparities in the analyzed countries, using indicators that capture income inequality, the size of the middle class and the degree of income polarization, providing clues about the difficulties the households in the analyzed area are facing with.

Key words: inequality, middle class, economic development

J.E.L. classification: E25, E64, F63

1. Introduction

Dividing population into social classes is a permanent concern of both researchers and government authorities, because this information is very important to establish the public policies at the macroeconomic level. The size of the middle class could be a relevant indicator to study the standard of living, the poverty and the social inequalities in a given country and may indicate the level of its economic development. Based on this information, the state can make economic policy decisions to protect people in difficulty.

The middle class in Romania has gone through three stages in the last one hundred years. First, during the interwar period, there was a process of transition to a capitalist economy. Then, the communist regime established in Romania in 1945 dissolved the middle class created during the interwar period and created a new middle class associated with the industrialization process of the postwar period. The transition from a command economy to a market economy led to important transformations in the economic and social structure of Romania. The free initiative, the openness to the West, the emergence of multinational corporations, and the increase in the population's income led to the emergence of the present middle class, made up of the most dynamic, creative, and educated part of this country's population.

The mission of the middle class is conditioned by the functions it performs within the society. The middle class constitutes the social foundation and the main force of reforms, ensures the reproduction of highly qualified labor force, contributes to the development of technical, scientific and social progress, applies innovations, preserves the unity and cultural identity of society. A large and dynamic middle class is important for any nation. It contributes to both economic growth and social and political stability.

Given the adherence to the European Union and the economic growth, the rise of the middle class in Romania is evident. The implications of its rise are profound, both in terms of generating economic opportunities and in terms of transforming the political class. There is no unanimously accepted definition of what the middle class means, but the most frequently used method to delimitate it is the income method, which has many drawbacks.

2. Literature review

The notion of "middle class" has a long history. It is argued that, for the first time, the respective notion was used by the playwright Euripides (5th century BC), designating three classes in society: the rich, the poor and the middle class. In the pre-industrial society, the middle class was analyzed as a residual social category. Thus, individuals who did not hold noble titles and were not part of the peasant class were included in this class, such as small entrepreneurs, merchants, manufacturers and other similar categories. The composition of this class varied considerably depending on the national context and the historical period analyzed.

The middle class, as a well-defined entity, occurs during the industrial society. The social and economic transformations generated by the industrial revolution led to the reconfiguration of the traditional social structure and the rise of a new class - the middle class - as a central actor in the industrial society development. This social category was defined both by its intermediate economic position between the working class and the elite of capital holders, and by a distinct lifestyle, characterized by the values of work, education, civic responsibility and the aspiration towards stability and social ascension.

The middle class has been the subject of the sociological and economic studies since the second half of the 20th century. As a result of the scientific and technological revolution and the economic growth it generated, the share of poor population decreased, and the emergence of another type of state, called the social state or the development state, contributed to the expansion and consolidation of the middle class, which became predominant in the advanced capitalist countries (Tikhonova, Mareeva, 2004, p.46).

Many researchers emphasize the role of the middle class in developing democracy, social cohesion, economic prosperity, and political stability. These studies consider the middle class as a driving force that facilitates the economic growth by promoting stability, human capital accumulation, and a better infrastructure (Landes, 1998, p.15, Pressman, 2007, p.41, Estache and Leipziger, 2009, p.176).

A very common approach in the specialized literature is to define the middle class as a range of income values, with minimum and maximum limits relative to a mean (Thurow, 1987, p.30, Horrigan and Haugen, 1988, p.5). Another approach defines the middle class as a core group of the population, a percentage of the total population (Beach et al, 1997, p.134).

Some international organizations have also recognized the importance of the middle class in supporting consumption, significant investments in education, health and housing, as well as for the essential role it plays in supporting the social protection systems through tax contributions (OECD, 2019).

There is no consensus on the definition of the middle class, and different definitions have been developed for different purposes and countries, at various stages of social and economic development.

In Romania, the first approach regarding the class structure in our country was made by D. Draghicescu, who identified the social categories after the Great Union of 1918: the large landowners, the urban bourgeoisie, the freelancers, the civil servants and the medium-sized rural landowners, the peasants and the village civil servants; the proletariat of the large industry and the craftsmen (Draghicescu, 1922, p. 38).

Virgil Madgearu, a Romanian economist, sociologist and politician, was a prominent advocate of the middle class, especially the rural and urban petty bourgeoisie, and of the peasantry as an essential economic and social force. He addressed the issue of developing a stable middle class, through social protection policies, cooperative and agrarian reforms. Madgearu argues that the Romanian economy must be built on the basis of the peasant household, seen as part of an indigenous middle class. He combats the capitalist-industrial model imported from the West, advocating an economic

development specific to the Romanian social structure (Madgearu, 1923, p.58-59). Madgearu emphasizes the importance of the small and medium-sized peasant households as the basis to develop the national industry and for the social stability. He considered this to be the only solid basis to develop a large national industry which, in turn, by encouraging the growth of the urban population and raising its well-being, will contribute to the formation of an intense market for the peasant household products – a necessary condition for its intensification (Madgearu, 1936, p.73-76). Thus, Madgearu highlighted the importance of developing an economy based on small peasant households and a solid middle class, considering that such an economic structure would ensure Romania's economic independence and contribute to its social stability.

Another approach from the interwar period belongs to Maria Larionescu. The author carried out an in-depth analysis of the papers related to social classes, with an emphasis on the middle class: the old middle class, related to property and the new middle class, resulting from the accumulation of capital (Larionescu, 2007, p.35-37). The categories of population that belonged to the middle class are highlighted: the independents, the self-employed, the professionals, the management staff of the enterprises, the small craftsmen and the workers with a patent.

The abolition of private property by the communist regime established in Romania after the World War II, the destruction of the bourgeoisie and landowner classes diminished the size of the middle class. The Revolution of December 1989 reopened the path for the private property and the respective social classes.

In a reference paper on the structure of the middle class in Romania, Ioan Marginean identifies four coverage spheres of the middle class (Marginean, 2020, p.147):

- the active population in a restricted (congruent) format with non-manual occupations (the first four ISCO code groups) and educational training at least at high school level (high school, post-secondary or master's school, higher education);
- all non-manual activities included in the four codes, regardless of educational training;
- activities in non-manual occupational groups and the other part of the active population with an educational level of at least high school level;
- the active population mentioned above plus the other part of the country's population with high school or higher education.

Most Romanian economists have seen the middle class as a pillar of social, economic and democratic stability, but they have always been aware of its fragility in Romania. From the small-scale peasantry of Madgearu to the small entrepreneur of today, the middle class has been and remains essential for the economic development and progress.

3. Research methodology

This analysis uses the most recent EU-SILC data and defines the social classes based on some pre-defined income thresholds. This is in line with the income-based approach mentioned above. As Table 1 shows, the distinction between the three income classes (low, middle and high) is made by means of determined thresholds, expressed as a percentage of the median disposable income of households in each European country. This report describes the evolution of the population share falling into each of these classes.

This analysis follows the empirical approach proposed by Gigliarano and Muliere (2012, p.22-23). The individuals are assigned to different income classes according to their disposable income, the table below shows.

Table no.1. The thresholds used to define the income classes

<i>Income class</i>	<i>Lower</i>	<i>Middle</i>	<i>High</i>
Share of average household disposable income	< 75%	75 – 200%	> 200%

This research defines the middle class in each country as consisting of people whose household disposable income is between 75% and 200% of the national median disposable income.

The income distance indicator, which measures the relative distance, expressed as a percentage, is calculated using the relation below:

$$\text{Income distance indicator (\%)} = \left(\left(\frac{\text{Income of individual } i \text{ in country } j}{\text{Income threshold of reference}} \right) - 1 \right) * 100$$

The income polarization can be calculated separately for each income class, as the average of the income distance indicator for all individuals in that class. Subsequently, the total income polarization in a country is determined as the average of the income distance indicator for the entire population.

Materials and methods. This paper presents an empirical analysis of income polarization resulting in a trend overview of income distribution in Romania and the European Union member states. The analysis presents an approximation of income polarization for the middle class. The size of the middle class is analyzed over time, to see if it has increased or decreased. Its composition and changes over time are also examined.

We used an empirical approach to measure the income polarization for the entire population. The aim is to investigate whether polarization is increasing due to the deepening of the gap between different income groups. The analysis aims to highlight how the concentration of middle class's income contributes to income polarization.

4. Findings

Scholars from different fields of knowledge or from different institutions provided quite different, sometimes almost contradictory definitions to the middle class. This confusion stems mainly from the lack of some fixed criteria for such a definition (Tarkhnishvili A, Tarkhnishvili L.). In fact, the situation is the opposite: there are too many criteria, resulting from different perspectives and fields.

Many economic studies use income as a primary indicator to define the middle class membership. In one of its reports, the OECD uses income to analyze the middle class (OECD, 2019) and uses the term "middle-income class" instead of the term "middle class".

The report defines the "middle-income class" as the population living in households with incomes between 75% and 200% of the national average. For some analyses, the middle-income class is subdivided into three groups:

- Lower middle income (75%–100% of the average),
- Middle income (100%–150%),
- Upper middle income (150%–200%).

The population in households with incomes below 75% of the average is considered the "low-income class", and those with incomes above 200% of the average are part of the "high-income class".

The European Commission reports define the middle class in terms of income: people with an equivalent disposable household income between 75% and 200% of the national average (Eurofound, 2024, p. 63-69). Based on this definition, the European countries are mostly made up of the middle class. On average, the middle class in the European Union represented approximately 64% of the population in 2023, being more than twice as large as the low-income class (28%) and much larger than the high-income class (8%). There are no significant differences between 2023 and 2015, however, compared to 2007, the share of the middle class in the total population increased in the European Union by 6 percentage points.

There are differences between countries; among the countries analyzed, the middle-income population has the highest share in the Czech Republic, Slovenia and Slovakia (over 70% in 2023), while, at the opposite side, the share of the middle-income population is lower in Bulgaria (51% in 2023), Romania (59%) and Greece (61%).

In Romania, the middle class share rose to 60% in 2023 from 51% in 2007. The 9 percentage point increase was the highest in the region and resulted from the high-income class decrease from 14% in 2007 to 8% in 2023, as well as from the low-income class decrease from 35% in 2007 to 31% in 2023. Despite the upward trend, the size of the middle class in Romania remained the second smallest in the region after Bulgaria.

A larger middle class means a more cohesive society, with a higher proportion of families whose incomes are concentrated around the average level (Eurofound, 2017, p. 15-21). The extremely important role of the welfare state in redistributing income between households and compressing the

income distribution is reflected in the much smaller size of the middle class when it is calculated based on the market income, instead of the household disposable income (Eurofound, 2019, p. 3).

Table no. 2. The size of income classes by household disposable income

		Low income	Middle income	High income
EU 27	2023	28	64	8
	2015	29	63	8
	2007	32	58	10
Romania	2023	32	60	8
	2015	31	58	11
	2007	35	51	14
Czech Republic	2023	24	71	6
	2015	22	63	5
	2007	22	69	8
Croatia	2023	30	64	7
	2015	30	63	8
	2007	32	58	10
Poland	2023	26	68	7
	2015	30	61	9
	2007	29	60	11
Hungary	2023	26	68	6
	2015	28	64	8
	2007	24	70	6
Slovakia	2023	23	75	2
	2015	25	72	3
	2007	27	69	4
Slovenia	2023	25	72	4
	2015	26	70	4
	2007	28	66	6
Bulgaria	2023	35	51	14
	2015	34	53	13
	2007	32	48	20
Greece	2023	31	61	8
	2015	33	56	11
	2007	32	57	11

Source: EU-SILC 2024 (own determination).

The average size of the middle class in the EU Member States is falling from 64% of the population to 42%, which translates into an increase in the share of high-income classes (from 8% to 18%) and low-income classes (from 29% to 40%). Before the income redistribution made by the welfare state, the size of the middle class ranges from 52% in Slovakia (and around 50% in Hungary, Slovenia and Poland) to below 40% in Romania (39%) and Bulgaria (38%).

On the one hand, there is a group of countries where the middle class is relatively small before redistribution, but expands considerably after the application of taxes and social benefits. On the other hand, there are countries where the middle class is relatively large before redistribution, but becomes relatively small after the intervention of the welfare state. This is the case of Bulgaria and Croatia.

The analysis of the income structure shows that, in countries where the share of middle-class income has increased, this advance has generally occurred at the expense of the upper-income class. Conversely, in countries where the middle class has lost from its economic influence, the upper-income class has also benefited the most. This development suggests that, in countries where the middle class has shrunk, the incomes of the lower-income class have stagnated: although the share of the population with low incomes has increased, its contribution to the total income has not changed significantly.

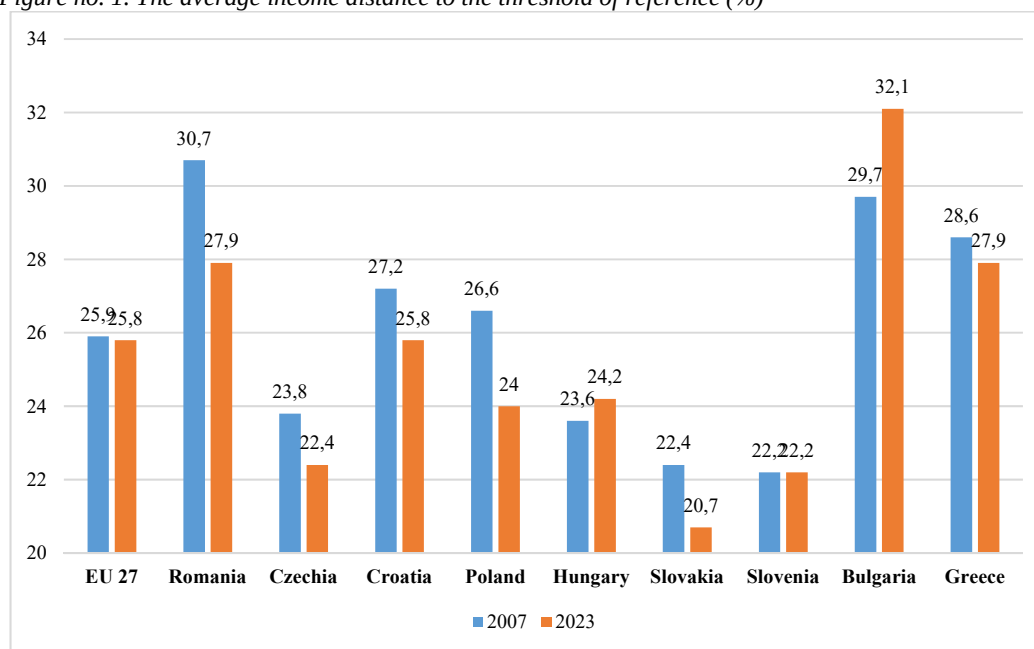
Table no. 3. The size of income classes by household by market income, 2023, %

	Low income	Middle income	High income
EU 27	40	42	18
Romania	42	39	19
Czech Republic	38	50	12
Croatia	39	45	16
Poland	38	47	15
Hungary	37	50	13
Slovakia	35	52	13
Slovenia	39	48	14
Bulgaria	39	38	23
Greece	40	42	18

Source: EU-SILC 2024 (own determination).

In addition to the analysis of the middle class size, this paper also analyzes the income polarization. The data for the analyzed countries show important differences between countries (Figure no. 1).

Figure no. 1. The average income distance to the threshold of reference (%)



Source: EU-SILC 2024 (own determination)

The income polarization varies considerably between countries, the lowest values being recorded by Slovakia (22.4% in 2023, respectively 20.7% in 2007) and Slovenia (22.2% in both 2023 and 2007), and the highest by Bulgaria (29.7% in 2023, respectively 32.1% in 2007), Romania (30.7% in 2023, respectively 27.9% in 2007) and Greece (28.6% in 2023, respectively 27.9% in 2007). The income polarization has decreased in the countries where the low- and high-income groups have moved closer together. In countries where polarization has increased, low- and high-income groups have moved further apart.

In some countries (Poland, Slovakia, the Czech Republic), the middle class has become more homogeneous, which means that the gap between the two groups has narrowed. There are countries (Slovenia, Greece, Hungary) where the middle class has become more homogeneous, but to a lesser extent and not necessarily by reducing the gap between the two groups. In other countries (Bulgaria, Romania, Croatia), the middle class has become more heterogeneous, the gap between the low-income and high-income groups has increased.

5. Conclusions

In recent decades, the middle class has become a central topic in the economic and social analyses, being perceived as an essential pillar of sustainable development and democratic stability. The international studies highlight the fact that a strong middle class contributes to economic growth, reduces social polarization and supports the functioning of democratic institutions. In Romania, the evolution of the middle class has been strongly influenced by the post-communist transition, the economic reforms, but also by the recent economic and financial crises.

The changes in the size of the middle-income class are influenced both by the income increase for the people around the average income level and by the changes in the average income, which is used as a reference to define the income class thresholds. Given the significant reduction in the average income level, the size of the middle class may remain broadly similar, without reflecting the actual deterioration in the income level of this class.

The middle class (defined as people with a disposable income between 75% and 200% of the national average) represents most of the population in all EU Member States. However, its size varies considerably: it exceeds 75% of the population in Slovakia (and it is also relatively high in Slovenia or the Czech Republic), but drops to 51% in Bulgaria, and it is also relatively small in several countries in Central and Eastern Europe and the Mediterranean, including Romania.

Countries with a small middle class tend to have weaker social protection systems, with little impact on reducing market income inequalities. The weakness of the welfare state in these cases partly explains the high levels of income inequality and the small size of the middle class.

A large middle class is typical for the European models and reflects an inclusive society. The analysis highlights the increase of the middle class in most of the countries analyzed between 2007 and 2023, even significantly in several countries in Central and Eastern Europe (Romania, Poland, Croatia).

A specific analysis of polarization within the middle class shows that it has become more heterogeneous in less than half of the countries analyzed (including Slovenia, Greece, Hungary). In contrast, the middle class has become more homogeneous in over half of the countries (including Romania, Bulgaria, Croatia).

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Romania and the Eurozone Accession: The Nominal Convergence Criteria

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Abstract

Through the Treaty of Accession to the European Union, Romania has committed to adopt the European currency. The purpose is to analyze how Romania meets the nominal convergence criteria necessary for the admission to the eurozone. Romania has postponed the deadlines set for joining the eurozone several times, raising questions regarding the capacity of the Romanian economy and political decision-makers to make the optimal decisions to meet the nominal convergence criteria. This research is predominantly conceptual, but it also includes elements of empirical testing. We would mention that the analysis of the nominal convergence criteria alone is not sufficient to determine whether a country is ready or not for euro adoption; a complete analysis should also take into account the analysis of the real convergence criteria as well as the cost and benefits of this process.

Key words: convergence criteria, euro, monetary union

J.E.L. classification: E52, E58

1. Introduction

Like any member state of the European Union, Romania committed through the accession pact to adopt the single currency. Therefore, Romania's integration into the eurozone is a topical issue, given the macroeconomic context. Given the situation, it is important to know and understand the provisions of the European Union, the advantages and disadvantages of integration into the eurozone, as well as the terms our country has to meet in order to comply with the obligations it assumed.

There are therefore a series of criteria for a country to be admitted in the eurozone and some guiding principles to assess how these criteria are met. First, only the states with favorable economic situations can join the eurozone. Therefore, in addition to the nominal convergence criteria, certain real convergence criteria must also be met. Second, it should be noted that all nominal convergence criteria must be met, all being considered equally important. Also, the fulfillment of these criteria is assessed exclusively on the basis of concrete empirical data, and the process is transparent. In addition, increased attention is paid to the convergence sustainability, since the economic developments are analyzed over the long term.

Joining eurozone represents a defining moment for Romania in its process of consolidating a sustainable economic stability. However, such a decision must be well-founded, supported by a sustainable fiscal position and a robust framework of internal financial stability. The macroeconomic dynamics suggest that the euro adoption in the short term is unlikely, as the convergence criteria have deteriorated rapidly in recent years.

2. Literature review

The adoption of the single European currency began in 1999, with the integration of the first group of 11 member states, joined by others over time. The eurozone is currently composed of 20 member states. Six other member states (Bulgaria, the Czech Republic, Hungary, Poland, Romania and Sweden) are outside the eurozone, having the status of states with a derogation, while Denmark

benefits from an opt-out clause provided for in the treaty protocol. Among the states not part of the eurozone, Bulgaria has been accepted into the European Exchange Rate Mechanism (ERM II) and will probably join the eurozone on January 1st, 2026.

The eurozone is expected to expand. Apart from Denmark, which benefits from the opt-out clause, Sweden has indefinitely postponed its accession to the euro area. The other 5 countries will sooner or later adopt the single European currency, with Bulgaria and the Czech Republic being the best positioned. These countries and the European institutions consider that the adoption of the single currency, only as a result of meeting the nominal convergence criteria, without an adequate preparation and a macroeconomic stability, can generate significant risks both for their stability and for that of the eurozone (Kopits, 1999, p. 23).

The debates for or against the adoption of the single European currency focus on the costs and benefits associated with the adoption of the single European currency. The benefits could result by eliminating the costs associated with the foreign exchange, the reduction of financing cost and inflation (Socol, C., Socol, A., 2007, p.53). The theory demonstrates that countries can benefit from the existence of a common currency, as it allows them to avoid many adjustment problems (Socol, A., 2011, p.90). An important issue related to the adoption of the euro is transfer control over the monetary policy independence and the exchange rate mechanism (McKinnon, 1963, p.720), as a result the national central banks can no longer use specific monetary policy instruments to mitigate domestic economic shocks. In the case of Romania, joining the Eurozone implies a transfer of monetary policy responsibilities from the National Bank of Romania to the European Central Bank, since the macroeconomic dynamics of the Eurozone will prevail over national particularities (Schipor, 2020, p.198). The advantage of joining a monetary union, consisting of minimizing the transaction costs, comes with the disadvantage of giving up the exchange rate of the national currency, as an economic policy instrument (Anastasei, 2006, p.19).

Therefore, the theory of optimal currency areas constitutes an essential theoretical framework to analyze the correlation degree of the economic shocks between Romania and the eurozone. This theory emerged from the desire to clarify the opportunities of having a fixed or flexible exchange rate (Mundell, 1961, p.658). Mundell concludes that the geographical mobility of the labor force eliminates the need for a flexible exchange rate. Kenen (1969, p.42-43) argued that the industrial diversification would contribute to the optimality of the monetary union, because it would reduce the macroeconomic effects of the structural shocks, considered to be the greatest threat to the viability of a monetary union. He argued that the monetary union should be accompanied by a fiscal union. McKinnon (1963) argued that a flexible exchange rate becomes a less efficient instrument for rebalancing the current account and more harmful to the domestic price stability, because the exchange rate changes are counterbalanced by the price changes, without the change in the real exchange rate that would have been needed to rebalance the current account.

The specialized literature generally agrees on the need to identify an optimal moment for Romania's accession to the eurozone (Drăgan, Pascariu, 2008, p.37), avoiding both unjustified haste and excessive delays. A premature adoption of the euro, in the absence of a real convergence, would not be feasible, while a significant delay could lead to a decrease in public support.

The nominal convergence criteria are intended to ensure the macroeconomic stability in the countries applying for the eurozone membership (Krugman, Obstfeld, 2006, p. 234). However, there have been numerous criticisms of the relevance, applicability and efficiency of these criteria in the economic literature and in the European political debate. One of the most frequent criticisms is that the thresholds set (e.g. a 3% budget deficit or a 60% public debt of GDP) are arbitrary and do not take into account the economic particularities of each country (Holland and Portes, 2012, p.9). These limits were set within a specific historical context and may be irrelevant in the face of different economic realities or in times of crisis. Another major criticism is that meeting the nominal convergence criteria does not automatically imply real convergence (Diaz del Hoyo et al., 2017, p.21). This discrepancy may lead to economic tensions in the post-accession period, as the less developed countries do not have the necessary mechanisms to deal with the asymmetric shocks in the absence of their own monetary policy.

The uniform application of the criteria ignores the divergences between the economic cycles of the member states (Franks et al., 2018, p.12). There has been a significant increase in synchronizing the economic cycles between the member states of the eurozone. This trend suggests that the

economic fluctuations have become increasingly aligned within the eurozone, indicating a higher degree of cyclical convergence. However, although the economic cycles have become better synchronized, the pace of the economic growth has become increasingly divergent, indicating the persistence of some structural differences between the national economies.

Another criticism to the nominal convergence criteria was driven by the experience of the eurozone sovereign debt crisis of 2009-2012, which demonstrated that the compliance with the Maastricht criteria was not sufficient to guarantee the macroeconomic stability of the member states (Franks et al., 2018, p.14). A country that was admitted to the eurozone after formally complying with the criteria, but subsequently faced a severe economic crisis, raises questions about the effectiveness of these rules as a preventive mechanism.

The nominal convergence criteria remain a necessary tool to establish a macroeconomic stability framework, but they are insufficient to guarantee a successful monetary integration. The adoption of the euro must be based on a more comprehensive approach, including real, institutional and structural convergence criteria, to ensure the long-term sustainability of participation in the eurozone.

3. Research methodology

In the early stages of a research project, choosing an appropriate methodology is essential for a deep and correct understanding of the subject. This paper mainly uses a quantitative research methodology, based on secondary data sources, such as books, scientific papers and reports provided by some international organizations.

The research objective is to observe the transformations the Romanian economy has undergone and to identify similarities with the countries of Central and Eastern Europe with the aim of exploring the opportunities and prospects of adopting the single European currency.

The research methodology is based on the analysis and interpretation of data provided by Eurostat, Romanian National Bank and European Central Bank. To achieve the desired results, I utilized theoretical research, data analysis and synthesis. The theoretical research consisted of literature review, in order to build a conceptual framework and to understand previous conclusions in the field. The data analysis was used to interpret the economic indicators and statistics published by Eurostat and other international institutions. The synthesis was applied to formulate conclusions based on the analyzed data and to identify possible future development directions for Romania.

4. Findings

According to the Treaty of Accession to the European Union, all states that become members of the European Union must adopt the single currency, the euro, after a certain period, more or less extended. Thus, a new member of EU, automatically entails its entry into the Economic and Monetary Union. Romania was admitted to the EU on January 1st, 2007, meaning that the next step is to prepare the national economy to adopt the single currency. As a candidate state, Romania is currently considered a country with a derogation from the adoption of the single currency (art. 122 of the Treaty).

The adoption of the euro by Romania is conditioned by the simultaneous and sustainable meeting of the nominal convergence criteria (European Commission, 2024, p.124-140). Romania must meet four convergence criteria of a monetary and fiscal nature:

1. The inflation rate must be at most 1.5% per year higher than that recorded in the three member states with the lowest inflation;
2. The government deficit must be less than 3% of GDP, and the public debt must be less than 60% of GDP;
3. The national currency must be stable for at least two consecutive years, meaning it must remain within the $\pm 15\%$ fluctuation margins established in the treaty;
4. The long-term interest rate must not exceed by more than 2% the rate recorded by the three best-performing member states.

Inflation rate

The price stability criterion ensures a high degree of convergence in monetary policies. The Maastricht Treaty stipulates achieving price stability, requiring states to have an inflation rate close to that of the three member states with the lowest inflation. This means that a member state must have an average inflation rate over a period of at least one year that is less than 1.5 percentage points higher than the inflation rate of the three best-performing member states.

The longer-term price evolution has reflected a volatile macroeconomic environment, particularly in the last few years. Inflation has varied significantly across the countries under review over the analyzed period. The average inflation rate has been higher in all countries under review than in the eurozone. Initially, between 2013 and 2016, the inflation was low across all countries. Therefore, the monetary policy conditions have eased considerably. Inflation started to rise in 2017, leading to some monetary policy interventions conducted by the central banks in some of the countries under review. The outbreak of the pandemic in 2020 led to a significant decline in the economic activity that year. Inflation slowed in some countries but remained persistent in others, reflecting higher food and services prices and tighter labour market conditions. Inflation rose significantly in all countries in 2021 and 2022, driven largely by sharp increases in energy prices, as well as supply and demand imbalances caused by the pandemic and macroeconomic policy measures. Since the first months of 2022, Russia's war against Ukraine has amplified inflationary pressures. To counter this rise in inflation, most central banks have started to sharply raise their policy rates in 2021. After peaking in late 2022 and early 2023, inflation began to decline sharply as a result of previous monetary policy tightening, lower global energy prices, and easing cost pressures and supply constraints.

Table no.1 Inflation rate in the period 2013-2024

	2013	2014	2015	2016	2017	2018
European Union	1.3	0.4	0.1	0.2	1.6	1.8
Bulgaria	0.4	-1.6	-1.1	-1.3	1.2	2.6
Czech Republic	1.4	0.4	0.3	0.6	2.4	2.0
Hungary	1.7	0.0	0.1	0.4	2.4	2.9
Poland	0.8	0.1	-0.7	-0.2	1.6	1.2
Romania	3.2	1.4	-0.4	-1.1	1.1	4.1

	2019	2020	2021	2022	2023	2024
European Union	1.4	0.7	2.9	9.2	6.4	2.6
Bulgaria	2.5	1.2	2.8	13.0	8.6	2.6
Czech Republic	2.6	3.3	3.3	14.8	12.0	2.7
Hungary	3.4	3.4	5.2	15.3	17.0	3.7
Poland	2.1	3.7	5.2	13.2	10.9	3.7
Romania	3.9	2.3	4.1	12.0	9.7	5.8

Source: own processing based on Eurostat

At the beginning of the analyzed period, Romania had a low level of inflation, even registering deflation in 2015 and 2016, due to the reduction of the value added tax. The average inflation rate increased sharply in 2022, by almost 8 percentage points compared to the previous year. After 2022, when it reached a peak of 12%, inflation has decreased. In 2024, the inflation rate recorded by Romania was 5.8%, significantly higher than the reference value of 2.2%. A gradual reduction of this indicator is expected, due to the previous tightening of monetary policy and the further mitigation of cost pressures and supply bottlenecks, although the situation is uncertain, as tax increases are possible due to the high budget deficit, which would have the impact of increasing prices.

Long-term interest rates

Another indicator of nominal convergence is the interest rate level, which must not exceed in the long term by more than 2 percentage points the level of the member state with the lowest rate. The Maastricht Treaty stipulates that over a period of at least one year, a member state must have had a long-term interest rate no more than 2 percentage points higher than the average of the three member states with the lowest inflation.

We notice a decrease in the average long-term interest rates in the analyzed countries by 2021. In 2022, the year when high inflation was recorded both in the European Union and in the analyzed countries, the inflationary pressure, accompanied by increasing budget deficits after the pandemic crisis, determined the increase in interest rates on short-term loans. Financing costs differ from country to country, depending on the fiscal-budgetary situation of each country. Bulgaria and the Czech Republic benefit from the lowest interest rates, unlike Romania and Hungary at the opposite pole.

Table no. 2. The interest rate in some EU member countries in the period 2013 – 2024 (the Maastricht criterion)

	2013	2014	2015	2016	2017	2018
European Union	3.09	2.21	1.38	1.09	1.33	1.38
Bulgaria	3.47	3.35	2.49	2.27	1.6	0.89
Czech Republic	2.11	1.58	0.58	0.43	0.98	1.98
Hungary	5.92	4.81	3.43	3.14	2.96	3.06
Poland	4.03	3.52	2.7	3.04	3.42	3.2
Romania	5.41	4.49	3.47	3.32	3.96	4.69

	2019	2020	2021	2022	2023	2024
European Union	0.72	0.31	0.4	2.46	3.51	3.26
Bulgaria	0.43	0.25	0.19	1.53	3.75	3.93
Czech Republic	1.55	1.13	1.9	4.33	4.44	3.98
Hungary	2.47	2.23	3.06	7.57	7.51	6.5
Poland	2.35	1.5	1.95	6.05	5.8	5.53
Romania	4.54	3.89	3.62	7.48	6.71	6.32

Source: own processing based on Eurostat

The long-term interest rates in Romania were above the interest rates in most European countries over the analyzed period. Only Hungary has recorded higher values of this indicator in the last three years. Romania is therefore the second in the top of the most expensive loans that can be taken by an EU state, and the distance from the platoon of Central European countries with a similar currency regime has been maintained. The level of interest rates remains, however, problematic, especially since the public debt has increased significantly in recent years, with significant risks related to the costs of its refinancing.

Consolidated general budget deficit and public debt

Treaty of Maastricht provides for the sustainability of the public finances; this results from a budgetary position which does not show an excessive government deficit. Article 104 describes the excessive deficit procedure: the ratio of the budget deficit to GDP exceeds the reference value of 3%, and the ratio of public debt to GDP exceeds the reference value of 60%, except in cases where the debt ratio is diminishing sufficiently and approaching the reference value at a satisfactory pace.

Until the outbreak of the health crisis caused by the coronavirus pandemic, the budget deficits of European countries (including those analyzed) were reduced, with most countries falling within the 3% of Gross Domestic Product target set by the Maastricht Treaty. The budget deficit has increased since 2020, due to additional spending on healthcare and to support the economic activities affected by the pandemic. The energy crisis and the slowdown in economic activity caused by the war in Ukraine and the increase in military spending also put additional pressure on national budgets. The budget deficit in 2024 was lower than in 2023 in four of the analyzed countries. Three countries under review recorded budget deficit-to-GDP ratios above the reference value in 2024. The deficit was above the reference value in Poland (6.6% of GDP) and significantly exceeded the reference value in Romania (9.3% of GDP) and Hungary (4.9% of GDP). The deficit is at the reference level in Bulgaria (3% of GDP) and fell below the reference level in the Czech Republic (2.2% of GDP).

Table no. 3. The general budget deficit in some EU member states in the period 2013 – 2024

	2013	2014	2015	2016	2017	2018
European Union	-3.1	-2.4	-1.9	-1.4	-0.9	-0.4
Bulgaria	-0.7	-5.4	-1.9	0.3	1.6	1.7
Czech Republic	-1.3	-2.1	-0.7	0.7	1.5	0.9
Hungary	-2.6	-2.8	-2.0	-1.8	-2.5	-2.0
Poland	-4.2	-3.7	-2.6	-2.4	-1.5	-0.2
Romania	-2.3	-1.2	-0.5	-2.5	-2.5	-2.8

	2019	2020	2021	2022	2023	2024
European Union	-0.5	-6.7	-4.6	-3.2	-3.5	-3.2
Bulgaria	2.2	-3.8	-4.0	-3.0	-2.0	-3.0
Czech Republic	0.3	-5.6	-5.0	-3.1	-3.8	-2.2
Hungary	-2.0	-7.5	-7.1	-6.2	-6.7	-4.9
Poland	-0.7	-6.9	-1.7	-3.4	-5.3	-6.6
Romania	-4.3	-9.2	-7.1	-6.4	-6.6	-9.3

Source: own processing based on Eurostat

Romania fell within the budget deficit target until 2018. Romania was placed under the excessive deficit procedure starting from 2020, when a budget deficit of 9.2% of GDP was recorded. This value was exceeded in 2024, when, amid populist measures, the Romanian government decided on an unsustainable increase in salaries and pensions. In June 2024, the European Commission found that Romania had not adopted effective measures and made recommendations for correcting the excessive deficit. It is expected that the new government will apply fiscal correction measures to bring the public finances back on a sustainable path. This fiscal correction is necessary to reduce the costs of financing the public debt and to generate sustainability for the public finances.

In 2024, the share of public debt in GDP reached 81% for the European Union, decreasing compared to previous years, while the values recorded by the analyzed states that did not adopt the single European currency were lower or significantly lower than this threshold. The share of public debt in GDP was 24.1% in Bulgaria (the lowest value among the analyzed countries) and 73.5% in Hungary (the highest value). Compared to 2020, public debt increased in the Czech Republic and Romania, and decreased in the other non-euro analyzed states (and in the European Union) mainly due to the recovery after the pandemic.

Table no. 4. The public debt in some EU member countries in the period 2013-2024

	2013	2014	2015	2016	2017	2018
European Union	86.7	86.9	85.1	84.0	81.5	79.5
Bulgaria	17.0	27.0	25.9	29.1	25.1	22.1
Czech Republic	44.1	41.5	39.5	36.2	33.8	31.7
Hungary	77.2	76.5	75.7	74.6	72.0	68.8
Poland	56.9	51.1	51.1	54.1	50.4	48.2
Romania	37.8	39.1	37.7	37.8	35.3	34.4

	2019	2020	2021	2022	2023	2024
European Union	77.4	89.5	86.8	82.5	80.8	81.0
Bulgaria	20.1	24.4	23.8	22.5	22.9	24.1
Czech Republic	29.6	36.9	40.7	42.5	42.5	43.6
Hungary	65.0	78.7	76.2	73.9	73.0	73.5
Poland	45.2	56.6	53.0	48.8	49.5	55.3
Romania	35.0	46.6	48.3	47.9	48.9	54.8

Source: own processing based on Eurostat

Romania has met the convergence criteria for one indicator, the public debt. It was 54.8% in 2024, below the 60% maximum limit set by the Maastricht Treaty. The public debt has been growing rapidly in Romania since 2020, when it rose to 46.6% from 35% the previous year. The rapid rate of increase in the public debt is worrying (around 10 percentage points in a year), which, in the absence

of some proactive measures to sustainably reduce the budget deficits, it may compromise compliance with this criterion even in 2025. From a longer perspective, between 2013 and 2024, the public debt-to-GDP ratio increased significantly in Romania (by 17 percentage points).

Exchange rate

The exchange rate of $\pm 15\%$ is another convergence criterion for the eurozone stipulated by the Maastricht Treaty. The Treaty requires compliance with the normal fluctuation margins provided for by the exchange rate mechanism of the European Monetary System for at least two years without devaluing the national currency against that of another member state. More specifically, the member state has not devalued on its own initiative the bilateral central parity of its currency against the currency of another member state during the same period.

Among all the countries analyzed, Bulgarian leva is the only currency participating in ERM II. It was included in this mechanism in 2020. The Bulgarian leva was included in ERM II at a central parity of 1.95583 leva per euro, with a standard fluctuation band of $\pm 15\%$. The other countries examined practice different exchange rate regimes, in most cases in the context of a relatively high degree of exchange rate volatility. The Romanian leu, which was traded under a managed floating exchange rate regime, recorded a stable exchange rate, while the other currencies not participating in ERM II were traded under a flexible exchange rate regime and were characterized by a relatively high level of volatility. The Czech koruna, the Romanian leu and the Hungarian forint depreciated against the euro in 2024 compared with the previous year, while the Polish zloty appreciated.

Table no. 5. The exchange rate of various currencies during the period 2013 – 2024

	2013	2014	2015	2016	2017	2018
Bulgarian lev	0.00	0.00	0.00	0.00	0.00	0.00
Czech koruna	-3.30	-5.99	0.93	0.90	2.62	2.58
Hungarian forint	-2.63	-3.99	-0.42	0.46	0.72	-3.14
Polish zloty	-0.31	0.31	0.00	4.28	2.43	-0.11
Romanian leu	0.90	-0.56	-0.04	-1.01	-1.75	-1.86

	2019	2020	2021	2022	2023	2024
Bulgarian lev	0.00	0.00	0.00	0.00	0.00	0.00
Czech koruna	-0.09	-3.06	3.08	4.19	2.29	-4.65
Hungarian forint	-2.01	-7.98	-2.07	-9.14	2.41	-3.52
Polish zloty	-0.85	-3.38	-2.75	-2.65	3.08	5.20
Romanian leu	-1.96	-1.96	-1.72	-0.20	0.31	-0.56

Source: own processing based on Eurostat

The exchange rate of the Romanian leu was characterized by a low degree of volatility. From the perspective of compliance with the nominal convergence criteria, since the national currency does not participate, for the time being, in ERM II, a central parity has not been defined in relation to which the inclusion of exchange rate fluctuations in the ± 15 percent band can be assessed. However, the position with respect to this criterion can be assessed on the basis of the calculation method used by the Central European Bank in the convergence reports, namely the calculation of the maximum percentage deviation for a two-year period of the daily exchange rate compared to the average level of the month preceding this interval. The maximum value of the deviations did not exceed the limit of the fluctuation accepted for the entire period analyzed.

The table below presents the status of meeting the nominal convergence criteria in 2024.

Table no. 6. The Maastricht criteria in Romania in 2024

Nominal convergence indicators	Maastricht criteria	Romania
Inflation rate (HICP) (percentage, annual average)	< 1.5 pp above the average of the 3 best performing EU members (reference level: 1.0%)	5.8%
Long-term interest rates (percentages per year)	< 2 pp above the average of the 3 best performing EU members in terms of price stability (reference level: 3.14%)	6.32%
Exchange rate against the euro (maximum percentage appreciation (+)/depreciation (-))	± 15 percent	- 0.56%
Consolidated budget deficit (percentage of GDP)	below 3%	9.3%
Public debt (percentage of GDP)	below 60%	54.8

Source: own processing based on Eurostat

One may notice that Romania meets two criteria in 2024, the exchange rate stability and the public debt. The last criterion has been put under doubt since this year due to its high growth rate in the recent period.

5. Conclusions

According to the calculations of the Central European Bank, Romania met all the nominal convergence criteria in 2016. Previously, in the first convergence report as a member state, Romania did not meet the price stability criterion, a criterion that has not been met in the last few years. The long-term interest rate criterion was met since 2014, but as in the case of price stability, it has not been met in recent years, increasing the costs of financing the public debt for Romania. Regarding the budget deficit, Romania was in the excessive deficit procedure during the period 2009-2013, and also re-entered this procedure in 2020, with no real prospects of exiting this procedure in the following years.

Now Romania's main concern is to reduce the budget deficit. Achieving this objective would also place the public debt on a downward trajectory and reduce the interest rate in the long-term. The nominal convergence criteria must be met in a durable and sustainable manner, not just at a certain point in time. Developments so far show that most of the criteria have not been met for most of the time since accession to the European Union, and if they are met at a given point, this does not represent a guarantee that they will be met in the future.

Merely meeting the nominal convergence criteria is not enough for a country to benefit from joining the eurozone. Furthermore, the need for some economic policies that ensure the economic stability does not end with the adoption of the euro. Sustainable real convergence is a key condition for those economies that want to adopt a common currency and be resilient to adverse shocks.

Not only the failure to meet the nominal convergence criteria represents an obstacle to the adoption of the European currency. Development gaps can represent the essential obstacle to the adoption of the euro. The differences in the economic performance between countries can lead to the accumulation of ever-increasing external deficits. Therefore, for Romania, a premature accession to the eurozone is not desirable.

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Large Language Models and Transformer Architecture in Electricity Price Forecasting

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Abstract

Our research explores the application of Large Language Models (LLMs) and transformer-based architectures to the task of forecasting electricity prices in Romania's Day-Ahead Market (DAM) and Intraday Continuous Market (IDC). Using Amazon Chronos, a deep learning framework built on the T5 transformer architecture, we demonstrate the model's ability to capture complex temporal patterns, nonlinear dynamics and seasonal variations in electricity price time series. The research utilizes hourly price data from June 2024 to February 2025 and evaluates performance using standard metrics such as MAE, RMSE, MSE, MAPE and R^2 . Chronos models, particularly Chronos T5 variants, are shown to produce highly accurate forecasts and well-calibrated prediction intervals, even in volatile market conditions. The self-attention mechanism and temporal embeddings enable effective learning of long-range dependencies, while quantile regression supports probabilistic forecasting. Results indicate that Chronos achieves accuracy in DAM forecasting and performs competitively in the more volatile IDC, providing both point estimates and uncertainty ranges.

Key words: price forecast, electricity markets, large language models, transformer architecture

J.E.L. classification: C53, P18, D47

1. Introduction

Accurate forecasting of electricity prices in short-term markets is essential for energy trading, grid operations and the deployment of flexible assets such as storage systems (De la Torre et al., 2024), (Zhang and Fu, 2024). In this research, we apply Amazon Chronos, a deep learning time series forecasting framework accessed through the ChronosPipeline interface, to model and predict electricity prices on both the Day-Ahead Market (DAM) and the Intraday Continuous Market (IDC) in Romania (Bâra and Oprea, 2024), (Bâra, Oprea and Tudorică, 2023). The Chronos models effectively capture the temporal dynamics of electricity prices in both DAM and IDC. Forecasts closely track actual price trends, including volatile fluctuations and daily seasonality patterns. The analyzed dataset includes hourly electricity prices from the DAM and IDC over a multi-month period (Jun. 2024-Feb. 2025). The methodology consists of selecting appropriate model presets (chronos_tiny for CPU or chronos_small for GPU), training Chronos models (Salahuddin et al., 2022) with a prediction horizon of 24 hours and evaluating results using standard performance metrics: MSE, RMSE, MAE, MAPE and R^2 .

Built on the foundation of transformer architectures (Arroni et al., 2023), Chronos models are specifically designed to handle the complexities of temporal data, offering accurate forecasts across various domains such as energy, finance and retail. The core architecture leverages self-attention mechanisms, allowing the model to learn dependencies across different time steps and effectively capture long-range patterns, seasonal variations and trends in the data. One of the distinctive features of Chronos is its use of temporal embeddings, which help encode information related to

time, such as hour of the day or day of the week, into the model. This temporal context improves the model's ability to detect cyclical behaviors and seasonal shifts. Chronos also supports probabilistic forecasting through quantile regression, which enables it to provide uncertainty estimates in the form of prediction intervals. These intervals are particularly useful in applications where understanding the range of possible outcomes is as important as the forecast itself.

The Chronos family includes several model variants that differ in size and computational requirements. The smallest variant, `chronos_tiny`, is optimized for CPU use and provides fast training and inference, making it suitable for lightweight applications or environments with limited computational resources. `Chronos_mini` offers a balance between speed and accuracy, while `chronos_small`, `chronos_base` and `chronos_large` are deeper models requiring GPU acceleration, each offering progressively higher forecasting accuracy. For scenarios demanding high robustness, Chronos also supports ensemble variants that combine multiple models to improve generalization. Chronos models are effective in scenarios where traditional time series models may fall short, such as in the presence of non-linear dynamics, multiple seasonal patterns or high volatility. In the context of electricity markets, Chronos has been used to forecast prices in both the DAM and the IDC. These markets are characterized by rapid price changes and complex temporal structures, making them ideal candidates for Chronos-based forecasting.

2. Literature review

The authors of (Pinhão, Fonseca and Covas, 2022) introduced a novel methodology by forecasting the underlying market dynamics, specifically, the supply and demand curves derived from auction bids. Addressing the complexity of hourly market data with numerous block bids, the proposed model incorporated multiple seasonal effects and key market variables such as wind generation and load. Results showed that this approach outperforms traditional benchmarks and enhances ensemble model performance, underscoring the value of including bid-level information in electricity price forecasting. Another research introduced a multivariate elastic net model for forecasting German quarter-hourly electricity prices, focusing on the less-studied IDC and call-auction markets (Kath and Ziel, 2018). It also examined the influence of early DAM EXAA prices and links forecast accuracy to economic value, showing that simple trading strategies can yield substantial gains when paired with reliable predictions.

A novel approach to energy forecasting was proposed (Hubicka, Marcjasz and Weron, 2019) demonstrating that averaging DAM electricity price forecasts across multiple calibration windows (ranging from 28 to 728 days) outperforms using a single „optimal” window. Further improvements in accuracy were achieved by averaging forecasts from a few strategically chosen window lengths. Additionally, (Bâra, Oprea and Ciurea, 2024) explored the evolution of electricity prices in Romania's Balancing Market, aiming to improve forecasting in the current economic and geopolitical climate. An AI-driven approach was proposed, combining classifiers and regressors to first predict the imbalance sign, then forecast prices. Two prediction strategies were introduced: one based on averaging five ensemble machine learning models, and another using weighted combinations via linear regression or decision trees. The results provided actionable insights for market participants, supporting the development of optimal bidding strategies through the integration of supervised and unsupervised learning techniques.

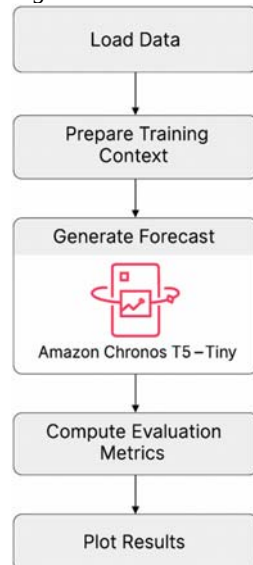
Another research presented a short-term electricity price forecasting framework that combines frequency analysis with price spike oversampling (Zhang, Fu and Gong, 2023). Variational Mode Decomposition (VMD) and Extended Discrete Fourier Transform (EDFT) were used to model price dynamics in the frequency domain. To enhance spike prediction, oversampling techniques like ESPO and SMOTE for regression were applied. Results across multiple markets showed the framework accurately forecasts both regular prices and spikes. The impact of rising renewable energy penetration on the variability of day-ahead electricity prices and the need for adaptable forecasting models were further investigated (Lehna, Scheller and Herwartz, 2022). A comparative study was conducted using four forecasting approaches for the German DAM: (S)ARIMA(X), LSTM, CNN-LSTM and a two-stage multivariate VAR model. Incorporating external factors such as load, fuel prices, CO₂ emissions, solar radiation and wind speed, the models were evaluated over

multiple forecast horizons. Results showed that LSTM performs best on average, while the two-stage VAR excels in short-term forecasts.

3. Research methodology

When using Amazon Chronos through the ChronosPipeline interface, the process of time series transformation is streamlined for effective forecasting. This transformation involves preparing the input data into a format that the pre-trained Chronos T5 model can understand, along with normalization and structuring that aligns with the model's transformer-based architecture. The core transformation begins with selecting a segment of the historical time series to serve as the training context (as in Figure 1). The Price_DAM values are extracted from the DataFrame and converted into a PyTorch tensor. This tensor, representing a continuous univariate time series, becomes the input context from which the model generates future predictions. The model is not retrained; instead, it performs zero-shot or few-shot inference, using its pre-trained understanding of time series behavior. Internally, the Chronos model expects the input to be a fixed-length sequence. It applies positional encoding to represent the order of time steps and captures temporal patterns through self-attention mechanisms, characteristic of transformer architectures. The forecasting task here is formulated as a sequence continuation problem, where the model generates the next n steps (defined by prediction_length) based on the provided context. Importantly, the transformation is more about sequence extraction and structuring than traditional preprocessing like frequency resampling or feature engineering. Unlike the AutoGluon API, the ChronosPipeline expects raw numerical values and does not require explicit timestamp columns or item identifiers. Time is handled implicitly by the model's positional encoding rather than through timestamp-based features. Figure 1 shows the proposed methodological flow.

Figure no. 1. Methodological flow



Source: Authors' contribution

The output of the model is a probabilistic forecast, a distribution over multiple future scenarios. These forecasts are post-processed using `numpy.quantile()` to extract the 10th, 50th (median) and 90th percentiles, allowing for interval-based forecasting. This is an essential feature of Chronos, as it enables point predictions and also uncertainty quantification, which is especially valuable in volatile domains like electricity markets. Therefore, time-series transformation in this Chronos setup involves selecting and slicing the appropriate historical window, converting it to a numerical tensor and interpreting the model's output in a probabilistic way. The process is minimal and model-centric, relying on Chronos's pre-trained representations and transformer-based architecture

to extract and learn time dependencies, rather than on manual feature design or extensive preprocessing.

Large Language Models (LLMs), particularly models like Amazon's Chronos T5, are applied to numerical time series forecasting, linking the core concepts of language modeling to the domain of temporal prediction. Originally designed for Natural Language Processing (NLP) tasks like translation, summarization and text generation, LLMs have proven surprisingly effective in modeling structured numerical sequences as well, including time series data, by leveraging the same foundational concepts that underpin language understanding. At the core of an LLM like T5 (Text-to-Text Transfer Transformer) lies the transformer architecture, which uses self-attention mechanisms to capture dependencies across sequential data. In natural language, this means learning relationships between words; in time series, it means learning patterns, trends and dependencies across time steps. When adapted for forecasting, time series values are treated similarly to words in a sentence, each point in the series is a "token" with contextual meaning shaped by its position in the overall sequence. Chronos T5 follows a naming convention similar to that of the original T5 models, offering a range of variants as in Table 1 that trade off between computational efficiency and forecasting accuracy.

Table no. 1 Chronos T5 variants

Model Variant	Parameters (approx.)	Description	Ideal Use Case
chronos-t5-nano	~25 million	Extremely lightweight version, very fast and resource-light	Quick tests, edge devices, micro-batches
chronos-t5-tiny	~60 million	Small and efficient; good balance for CPU inference	Short-horizon forecasting on CPUs
chronos-t5-mini	~100 million	Larger context and more accurate forecasts	Standard applications, longer sequences
chronos-t5-small	~250 million	Higher accuracy with broader temporal dynamics	Multi-step, volatile time series
chronos-t5-base	~500 million	Strong baseline model with powerful pattern learning	Energy, finance, and industrial data
chronos-t5-large	~770 million	Most powerful version for highly accurate long-horizon forecasts	GPU-only, high-resource environments
chronos-t5-ensemble	Varies	Ensemble of multiple variants with quantile averaging	Max accuracy, production forecasting

Source: Authors' contribution

In the Chronos T5 model, the numerical time series is tokenized and embedded, allowing the transformer layers to attend over historical values and generate coherent forecasts. This process can be seen as a form of sequence-to-sequence learning, where the "input sentence" is a segment of past observations and the "output sentence" is the model's prediction of future values. The model learns the local temporal structure and also global patterns such as seasonality and trends, much like how it learns grammatical rules and context in language. One of the key advantages of using LLMs in this setting is their ability to generalize across different types of time series without task-specific tuning. Trained on a large and diverse corpus of temporal data (similar to how LLMs are pretrained on vast text corpora), Chronos T5 develops a form of "temporal literacy", it learns abstract representations of time and variability that transfer across domains, including energy markets, e-commerce, finance, retail and more.

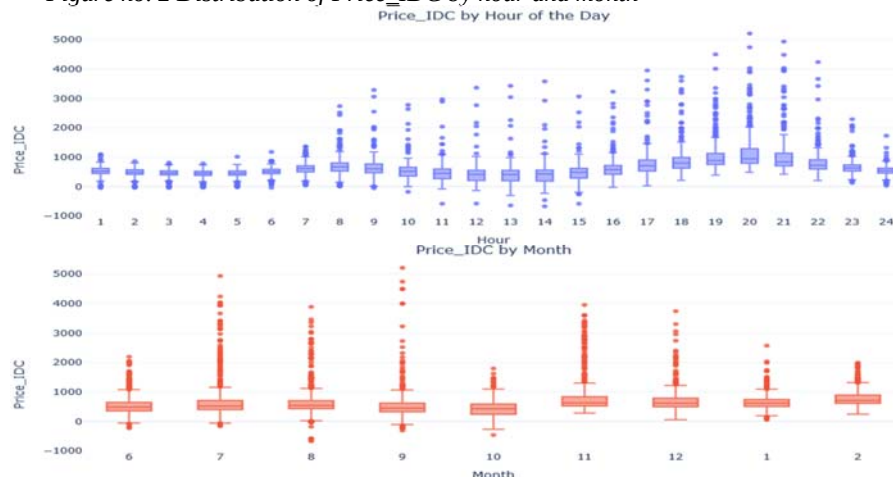
Moreover, the generation process in Chronos T5 is probabilistic, akin to language generation models like GPT. Rather than predicting a single deterministic output, it can generate multiple plausible future sequences from which prediction intervals (e.g., 10th, 50th, and 90th percentiles) can be derived. This is essential in domains like electricity price forecasting, where uncertainty and volatility are inherent to the system. Importantly, the shift from classic statistical models or task-specific deep learning architectures to LLM-based models also changes the way forecasting is approached. Instead of explicitly engineering features (e.g., lag values, holiday flags), the model implicitly learns what matters through attention weights, leveraging its massive parameter space and pretraining to detect subtle dynamics in the data.

Thus, the application of LLM concepts to numerical time series forecasting leverages the same strengths that enhanced NLP: self-attention, transfer learning, generative modeling and scalability. Amazon Chronos T5 treats time series as a structured "language" of numbers, enabling it to generate highly expressive and context-aware forecasts, a significant advancement for complex prediction tasks such as electricity market modeling.

4. Findings

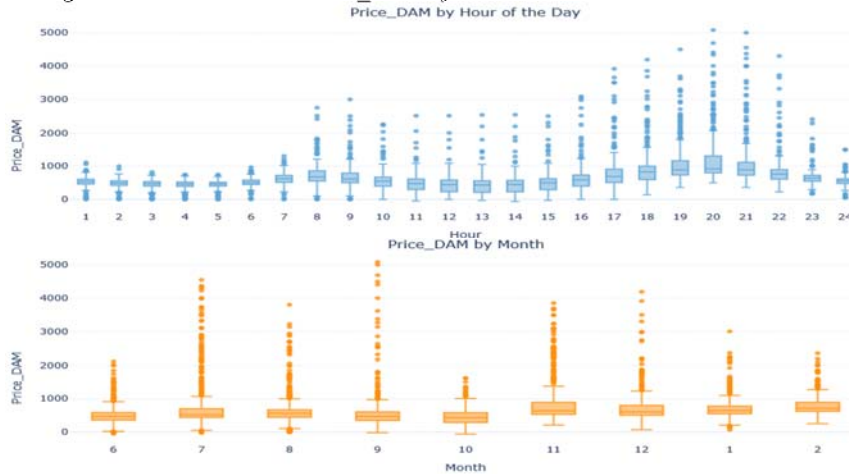
Figure 2 (top) illustrates the distribution of Price_IDC across different hours of the day. It shows a clear pattern where prices start relatively low and stable during the night and early morning hours. As the day progresses, particularly from around 8 AM onward, both the median prices and the variability increase. The highest prices and the widest spreads occur in the evening hours, especially between 6 PM and 9 PM. This suggests that demand spikes during these hours, contributing to price surges and a higher frequency of extreme outliers. After 9 PM, the prices begin to stabilize and gradually decrease toward midnight. Figure 2 (bottom) displays the distribution of Price_IDC across the months. The summer months: June, July, August and September, exhibit the highest volatility and price levels. Figure 3 (top) presents the distribution of Price_DAM across the 24 hours of the day. A distinct pattern emerges where prices are relatively low and stable during the early morning hours, from around midnight to 6 AM. Starting from 7–8 AM, the prices gradually increase, reaching their peak during the evening hours, especially between 6 PM and 9 PM. This is also when the price spread becomes most pronounced, indicating higher volatility and frequent extreme values. The behavior suggests a clear alignment with daily demand cycles, where consumption tends to peak during the evening. Figure 3 (bottom) illustrates the distribution of Price_DAM by month. During the summer months: June through September, there is greater price dispersion and higher median levels, pointing to increased market activity or stress. September shows particularly high volatility with a substantial number of outliers.

Figure no. 2 Distribution of Price_IDC by hour and month



Source: Authors' contribution

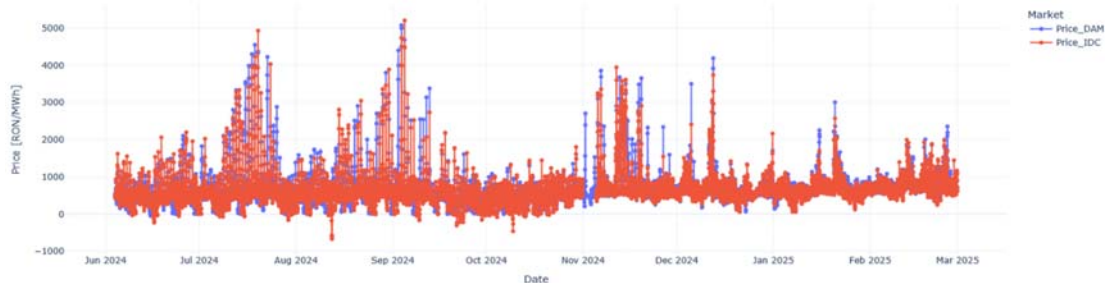
Figure no. 3 Distribution Price_DAM by hour and month



Source: Authors' contribution

Figure 4 shows the time series of Price_DAM, in blue and Price_IDC, in red from June 2024 to Feb. 2025. Both markets follow similar overall trends, with price spikes frequently aligning across the two series. However, Price_IDC appears slightly more volatile, exhibiting sharper fluctuations, especially during high-stress periods like July, August and September 2024. These months show the most extreme peaks, where prices often reach or exceed 4000–5000 RON/MWh. Starting from October 2024, both markets show a visible reduction in volatility and fewer extreme spikes. This calmer behavior continues throughout the winter months. Nonetheless, occasional price jumps are still observed, especially during colder periods (e.g., in December and January), driven by increased heating demand or market imbalances.

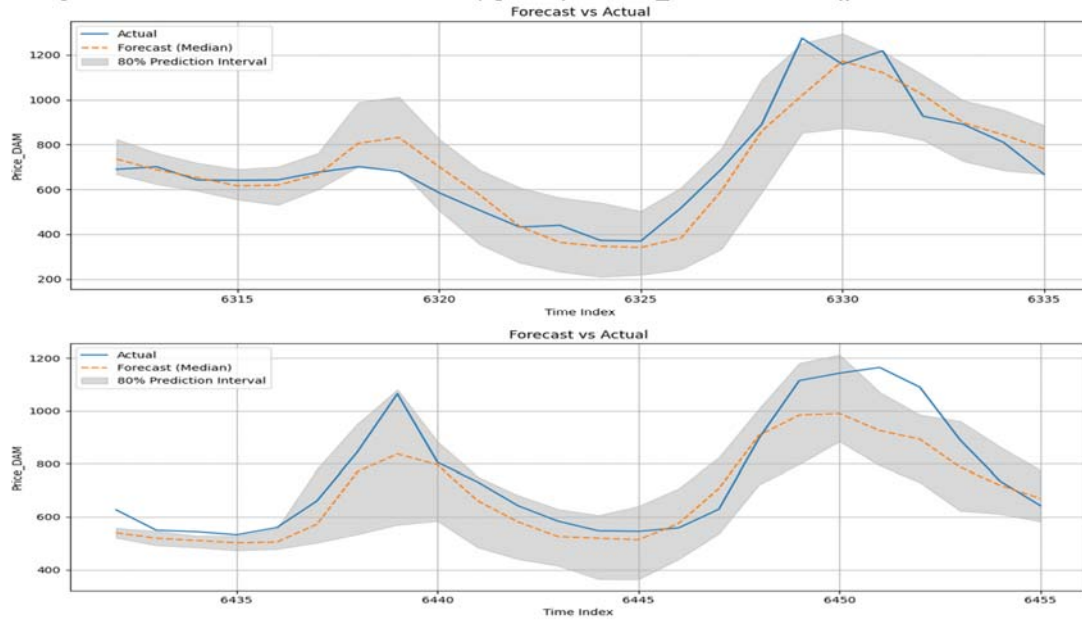
Figure no. 4 DAM and IDC prices from June 2024 – February 2025



Source: Authors' contribution

Figure 5 compare the forecasted vs. actual electricity prices for Price_DAM over two different time windows, using a median forecast with an 80% prediction interval. The solid blue line represents the actual prices, while the dashed orange line shows the forecasted median values. The shaded grey area indicates the 80% prediction interval, reflecting the uncertainty around the forecast. In the upper chart, the forecast captures the general trend quite well, especially the decline around time index 6320 and the sharp rise approaching index 6330. However, the forecast slightly underestimates the peak at index 6329–6331, although the actual values still fall within the prediction interval, indicating reasonable uncertainty bounds. In the lower chart, the model again successfully tracks the upward and downward movements, although it underestimates the magnitude of the peaks, particularly at index 6439 and again near 6450. Nonetheless, most of the actual values remain within the shaded prediction area, suggesting that the model is capturing the overall shape and variability of the price curve, even if it does not always match the precise amplitude. Overall, the forecast model demonstrates strong short-term accuracy in following daily price trends.

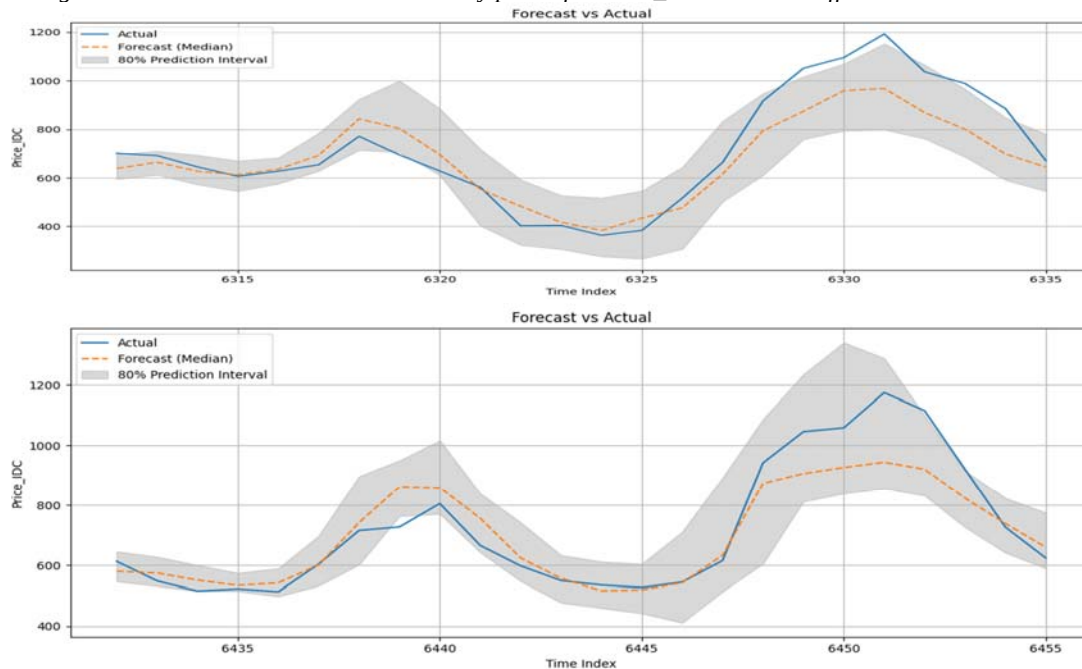
Figure no. 5 Forecasted vs. actual electricity prices for Price_DAM over two different time windows



Source: Authors' contribution

The forecast vs. actual plots for Price_IDC in Figure 6 show that the model captures the general pattern of the actual price quite effectively. In both time windows, the forecast median line follows the ups and downs of the actual prices with reasonable accuracy. The most prominent peaks, particularly around time indices 6330 and 6450, are slightly underestimated by the model, although the actual values still fall within the 80% prediction interval. This suggests that the model accounts for uncertainty well, especially during periods of rapid price change. The prediction interval widens appropriately during more volatile periods, indicating that the model is dynamically adjusting its confidence levels.

Figure no. 6 Forecasted vs. actual electricity prices for Price_IDC over two different time windows



Source: Authors' contribution

The error metrics for DAM and IDC in Table 2 indicate that the forecasting models perform well overall, with some variation across the two index ranges. For the DAM, Index1 (6315-6335) outperforms Index2 (6435-6455). The Mean Absolute Error (MAE) and Root Mean Squared Error (RMSE) are both lower in Index1, suggesting more accurate forecasts in terms of both average and standard deviation of errors. Although the Mean Absolute Percentage Error (MAPE) is slightly higher in Index1 at 9.47% compared to 9.33% in Index2, this difference is marginal. The R^2 score is stronger in Index1 at 0.864, indicating that around 86.4% of the variance in DAM prices is explained by the model, which reflects a high level of predictive accuracy. Index2, on the other hand, has a lower R^2 score of 0.7751, showing that the model's ability to capture variability in prices is somewhat reduced during this period, likely due to more unpredictable market behavior. In the case of the IDC, Index2 shows improved performance compared to Index1. The MAE and RMSE are both lower in Index2, with the RMSE dropping to 86.37 from 103.39. The MAPE also shows a notable decrease from 9.99% to 7.09%, indicating that forecasts in Index2 are more accurate in relative percentage terms. Additionally, the R^2 score improves to 0.8259 in Index2, suggesting that the model better captures the variance in IDC prices during this interval. Overall, the models demonstrate strong forecasting capabilities across both markets, with R^2 scores consistently above 0.77. The DAM forecasts are slightly more stable and accurate in Index1, while the IDC forecasts show significant gains in Index2. These results highlight that model performance can vary depending on temporal or market-specific factors.

Table no. 2 Performance metrics for the two-time indexes

	DAM Index1	DAM Index2	IDC Index1	IDC Index2
MAE	65.8337	77.3196	79.1581	59.7805
MSE	7896.998	10296.24	10690.32	7460.52
RMSE	88.8651	101.4704	103.394	86.3743
MAPE	9.47%	9.33%	9.99%	7.09%
R^2 Score	0.864	0.7751	0.798	0.8259

Source: Authors' contribution

The following observations are made: (1) DAM forecasting-performance was robust, especially under stable market conditions, where Chronos provided low MSE and high R^2 values; (2) IDC forecasting-due to higher intra-day volatility, IDC predictions were slightly less accurate, though still within acceptable error margins. Chronos' ability to produce probabilistic forecasts (via quantiles) offers valuable insights into price uncertainty.

5. Conclusions

Based on the provided text, several conclusions can be drawn regarding the use of large language models (LLMs) and transformer architectures, specifically Amazon Chronos T5, for electricity price forecasting in Romania's short-term markets. The Chronos framework demonstrates strong capability in modeling complex temporal patterns within both the Day-Ahead Market (DAM) and the Intraday Continuous Market (IDC). Its transformer-based architecture, which incorporates self-attention mechanisms and temporal embeddings, enables it to effectively capture non-linear dynamics, long-range dependencies and multiple seasonalities in electricity price data. The use of quantile regression for probabilistic forecasting adds further value by providing uncertainty estimates alongside point predictions, a critical feature for highly volatile markets.

The application of Chronos T5 showcases the adaptability of LLMs to numerical time series, leveraging techniques originally developed for natural language processing. The sequence-to-sequence formulation and token-based embedding approach allow the model to treat time series as structured "sentences" of data, enabling generalization across domains and reducing the need for manual feature engineering. This shift from traditional statistical models toward LLM-based forecasting represents a significant advancement in how time series problems are addressed.

Experimental results across two forecasting windows confirm the effectiveness of Chronos in both markets. In the DAM, the model achieved low error rates and high R^2 scores, particularly during stable market periods, indicating strong predictive power. For the IDC, which is inherently more volatile, performance was still robust, with the second index window showing notably improved accuracy and lower forecast errors. These results underscore the importance of probabilistic forecasting, as Chronos was able to provide meaningful prediction intervals even in turbulent conditions.

Finally, the overall forecasting framework is streamlined and computationally efficient, especially when using smaller Chronos T5 variants such as `chronos_tiny` and `chronos_small`, which balance inference speed with accuracy. This makes the approach scalable and practical for both research and operational deployment in energy trading, grid optimization and flexibility management. The findings highlight the transformative potential of LLMs in time series forecasting and suggest that transformer-based architectures like Chronos T5 are well-suited for modeling the intricacies of electricity markets.

6. Acknowledgement

This work was supported by a grant of the Ministry of Research, Innovation and Digitization, CNCS/CCCDI - UEFISCDI, project number ERANET-ERAMIN-3-ValorWaste-1, within PNCDI IV.

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Inflation Analysis and Impact on the Business Environment in Romania

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Abstract

This research deals with aspects related to the state of recession marked by the effects of inflation, thus analyzing how the business environment in Romania is affected, presenting statistical data from the period 2023 - 2024 regarding the number of suspended companies, in recession, but also the number of companies that were dissolved at the national level. Also presented, as results obtained from the research, are those areas of activity where significant fluctuations in the profitability rate were recorded, thus we can note the location of the effects in the field of trade, transport and storage, but also the regression that areas such as agriculture or the extractive industry recorded during the analyzed period.

An analysis of the inflation index at the national level was also carried out, an analysis carried out for the period 2022 - 2025, including estimated aspects for the fourth quarter of 2025, but also an analysis of the inflation rate of the European Union states, an analysis that highlights the fact that Romania recorded the highest inflation rate at the end of 2024.

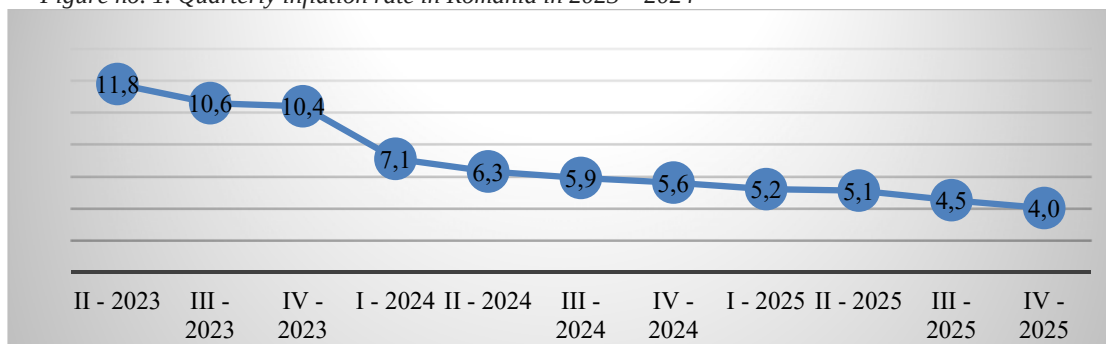
Key words: business environment, inflation, recession, cost, excise taxes

J.E.L. classification: A10

1. Introduction

The recovery process of the global economy continues as a result of the imbalances caused by the effects of the pandemic, but also by the effects of the war between Russia and Ukraine. In 2023, there was a slowdown in the pace of economic recovery, but it is noted that in the last period of action of the tensions recorded in the Middle East, there is an intensification of supply-side shocks. Although we observe a slowdown in the increase in interest rates by the main banks, all financial relations have become tense, thus generating uncertainties between economic budgets. It is estimated that inflation in the euro area will follow a downward path, but the pace is noted to be slow. (Armantier, 2015)

Figure no. 1. Quarterly inflation rate in Romania in 2023 – 2024



Source: INS, author's processing

From the data analyzed for the period 2023 - 2025, it appears that the Purchasing Power Index (CPI) has had a decreasing trend from the first quarter of 2023 to the present, with a further decrease expected throughout 2025. The pace of disinflation is thus estimated to have decreased from an inflation index of 5.6% recorded in the fourth quarter of 2024 to an index of approximately 4.0% at the end of the year in 2025, cumulating a contraction of 0.7% in the annual inflation rate. (Bhamra, 2023)

It is observed that the effect of the fuel excise tax increase in the second quarter of 2024 will lead to a contraction of 0.9% in the fourth quarter of 2024, thus estimating a reduction of 0.2% for the fourth quarter of 2025, thus we can deduce that the annual inflation rate calculated at constant taxes would be within the target range of 3.3% as early as the first quarter of 2025. The main opportunity in the period when inflation is more persistent is investments, as they are a way to protect ourselves from the disruptions generated by the effects of inflation. Investments made in shares help investors to profit from rising prices. In inflationary periods, an increase in investments in real estate and commodities can be observed. Effects of inflation: decreases in purchasing power are recorded; savings are encouraged; the cost of borrowing increases; depreciation of the national currency against other foreign currencies where inflation is lower. (Anghel, 2016)

2. Theoretical background

Inflation is considered a managerial issue for the business environment, because it leads to changes in costs, product prices and profitability. Increasing costs is a challenge for the business environment, so budget projection becomes much more complicated. (Candia, 2021) Inflation determines how profitable the business is as a result of fluctuations in demand for products and services. Inflation causes a decrease in spending by consumers, ultimately this will cause a decrease in sales volume and implicitly profit, in these cases it is recommended to diversify offers and adjust prices, so that the business environment's ability to respond to new market demands imposed by the inflationary factor ensures the long-term success of the business. Inflation causes operating costs to increase, all these fluctuations leading to a decrease in consumer purchasing power. Increasing wage costs, raw material costs ultimately put pressure on the company's budget and cash flow. (D'Acunto, 2021)

Inflation has an influence on the business environment, a first effect is the increase in production costs, which has repercussions on the increase in prices for raw materials, energy and wage costs. If companies do not find those strategies that allow them to partially transfer costs to customers, without suffering from the loss of customers and the decrease in sales volume, they will ultimately face the reduction of profit margins. A strategy to mitigate the decrease in the profit rate generated by inflation could be the reorganization and streamlining of the production process. (Del Negro, 2011)

In an inflationary environment, consumer behavior undergoes transformations, as they seek to be much more rational in terms of the demand for products and services or give up certain needs or postpone their purchase. (Boons, 2020)

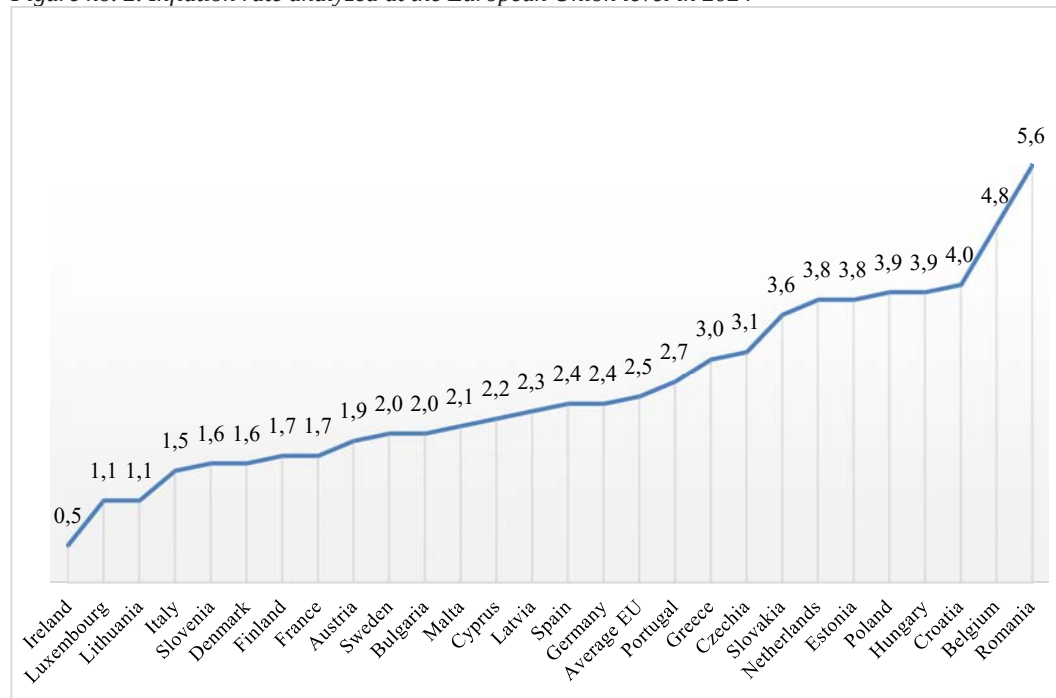
Thus, an adaptation of the offer, price reductions, and diversification of marketing strategies are required from the business environment to respond to new consumer preferences. (Malmendier, 2016)

During the inflation period, the need for working capital will increase to cope with the ever-increasing costs, and delays in paying invoices from customers who are also affected by inflation can generate imbalances within the company, so it is necessary to rethink payment terms in order to ensure a constant cash flow. (Ehling, 2018)

In the context of inflation, wage costs increase due to the demands that employees make from the need to maintain a standard of living equal to the previous one, unaffected by the decrease in purchasing power. Under these conditions, disagreements may arise between the employer and the employee. (Ichiue, 2015)

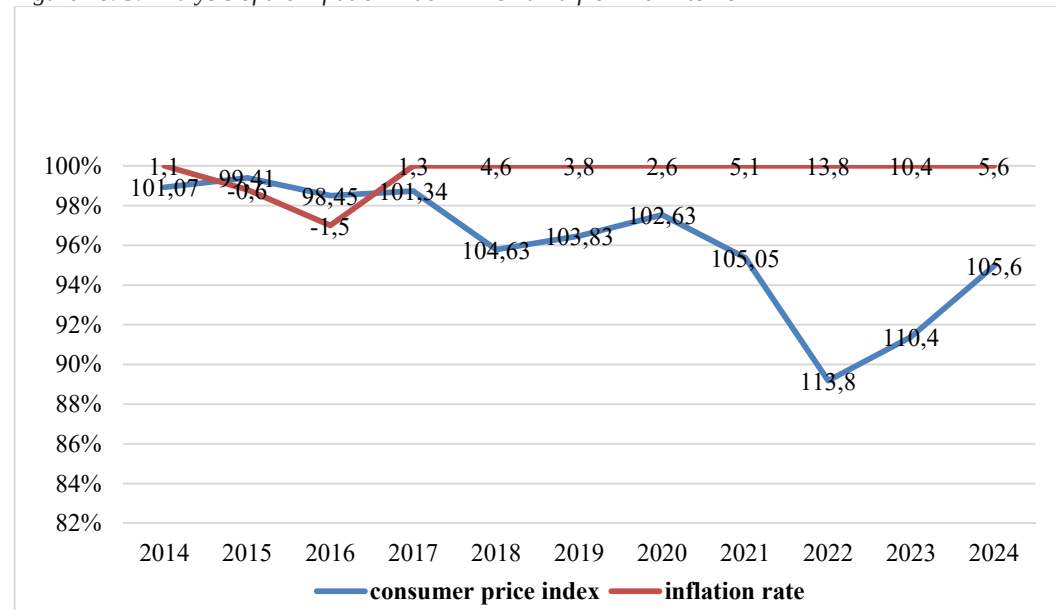
The period of inflation creates uncertainties regarding the viability of some projects and investments, which in such periods are forced to be postponed or even canceled due to economic uncertainties

Figure no. 2. Inflation rate analyzed at the European Union level in 2024



Source: EUROSTAT author's processing

Figure no. 3. Analysis of the inflation index in Romania from 2014 to 2024



Source: INS, author's processing

3. Research methodology

The research method adopted in this research is based on an analysis of the inflationary phenomenon and how it influences the evolution of the business environment in Romania.

By analyzing statistical data from the period 2014 - 2024, an analysis of the inflation index recorded in Romania was carried out, thus it is noted that in 2022 the highest inflation rate was recorded, reaching 13.8%, this situation being generated by the war between Russia and Ukraine.

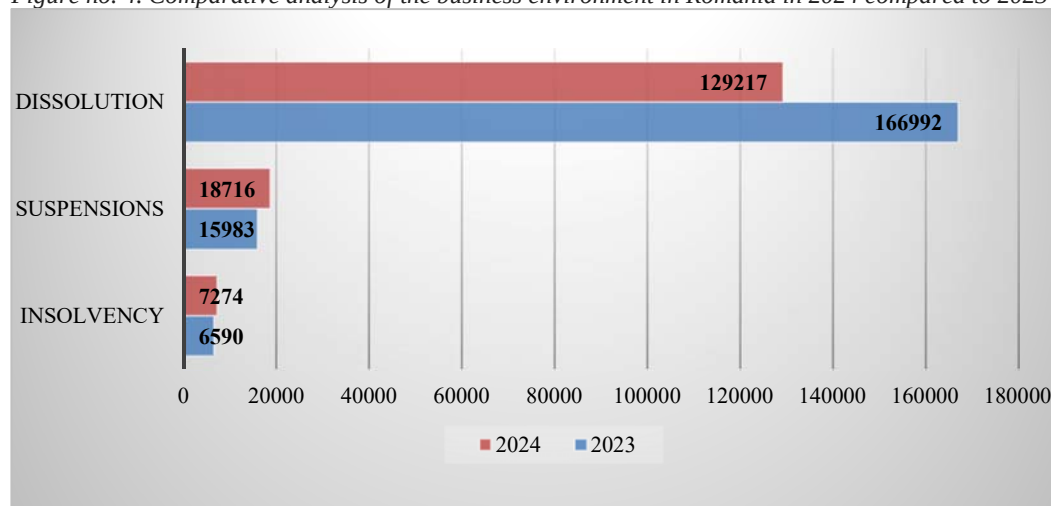
Statistical data on the inflation index for the period 2023 – 2024 is analyzed, but an estimated analysis of the inflation index for the year 2025 is also taken into account.

The method applied is based on identifying strategies that can provide shelter during periods of recession, so we can count that in the analysis period 2023 – 2024 at the national level the number of companies that entered insolvency increased in 2024 compared to 2023 by 9.4%, at least 9.4%, which above registered an increase in 2024 compared to 2023 by 17.2%.

4. Findings

In the analysis analyzed in this research, data from the period 2023 - 2024 were used, thus we can highlight a radiography of the business environment in Romania that reflects a consequence of the effects generated by the inflationary context, as follows: the number of companies that entered insolvency increased by 9.4% in 2024, during 2024, during 2024, during 2023, during 2023. company dissolutions recorded an increase of 17.2%.

Figure no. 4. Comparative analysis of the business environment in Romania in 2024 compared to 2023



Source: INS, author's processing

From the comparative analysis of the Romanian business environment, it appears that the number of newly established companies registered a decrease of 76%, from 8.6 thousand to 2.8 thousand new entities in Agriculture, and the decrease in the Trade area registered a decrease of 3.2 thousand while in the Construction field by 2.2 thousand, and in IT by 1.5 thousand in 2024 compared to 2023. The analysis shows that there were increases in new entities in the Transport and Storage activity field. Analyzing the registrations of new entities established from a geographical point of view, it can be seen that the largest decreases, ranging between one thousand and 1.9 thousand, were found in Bihor, Cluj and Bucharest.

The number of companies that entered insolvency increased from 6590 in 2023 to 7274 in 2024, which represents an increase of 9.4%, while suspended entities registered an increase of 14.6% in 2024 compared to 2023, thus reaching from 18716 entities in 2024 compared to 15983 in 2023. Deregistrations and dissolutions of entities in 2024 compared to 2023 registered an increase of 17.2% reaching 129217 entities in 2024 compared to 166992 in 2023.

In 2024, increases in the profitability rate were recorded in the following sectors of activity: trade (39% of the total), manufacturing industry (22% of the total), construction (8.3% of the total), energy and gas (5.6% of the total), transport and storage (5.0% of the total), while decreases were recorded in agriculture (5.6% of the total), energy and gas (17% of the total), extractive industry (38% of the total).

5. Conclusions

Inflation is considered a market force that is difficult to control, which is why it is necessary to diversify strategies to avoid or reduce losses generated by the decrease in purchasing power. Strategies that are required in periods of recession may consist of adapting the offer, reducing the price of products and services, and diversifying marketing strategies all aimed at satisfying consumer preferences. Inflation has an influence on the business environment, a first effect is the increase in production costs, which has repercussions on the increase in prices for raw materials, energy and wage costs. A challenge that persists in a period of recession is generated by the pressure that is created among entrepreneurs, pressures generated by the increase in wage costs and with them the emergence of tensions that can arise between the employee and the employer.

Another problem that the business environment faces is generated by the increase in working capital to cope with increasingly high costs, and delays in paying invoices from customers who are also affected by inflation, can generate imbalances within the company, thus it is necessary to rethink payment terms to ensure a constant cash flow.

The period of inflation creates uncertainties regarding the viability of some projects, of some investments, which in such periods are forced to be postponed or even canceled due to economic uncertainties. From the comparative analysis of the inflation index in 2023 and 2024, it appears that the number of companies that entered insolvency increased in 2024 by 9.4%, while the number of companies that chose to temporarily suspend their activity represented an increase of 14.6%, which justifies the smaller decrease in the number of companies in 2024 compared to 2023. We can see that in cities such as Cluj, Bucharest and Bihor, there was a downward trend in newly established companies.

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Landmarks of Constantin Stere's Economic Ideology

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Abstract

Constantin Stere (June 1, 1865, Horodiște - June 26, 1936, Bucov), founder of poporanism, an ideology that considered peasantry to be the fundamental factor of social progress, is one of the main personalities of the Romanian intellectual history. The purpose of this paper is to analyze the main features of Stere's economic thinking with regard to Romania's economic development (the agrarian reform and the role of the peasantry, foreign capital and its influence).

Key words: poporanism, agrarian reform, agriculture, hot money

J.E.L. classification: B31

1. Introduction

"The impetuous Narodnik who came rushing back from Siberia", as Costin Murgescu called Constantin Stere, had one "of the most passionate paths in life in the history of our modern political life" (Murgescu, 1990, p. 165)

Born in Basarabia, Constantin Stere attended a boys' high school in Chișinău. He was profoundly influenced by the ideas of the Russian Narodism, whose populist features marked his socio-political thinking, as it was proven by a statement he made in Parliament upon the revision of the Constitution: "A government that wastes money is a *popular* government from the electoral point of view" (Stere, 2023, p. 159). He got involved in the revolutionary activity and got exiled in Siberia for 8 years. He returned in the country in Iași in 1891 to continue his studies and he got his bachelor degree in law. He became professor of administrative and constitutional law at the Law School in Iași in 1901. He was elected Rector of the University of Iași in 1913.

After returning to the country, he became an influent personality of the socialist movement, but later he joined the Liberal Party, with direct help from Ionel Brătianu. Stere had his own vision regarding the economic progress of Romania. In the well-developed European countries, the agrarian issue depended upon solutioning the industrial issue. Over there the antagonisms of capitalism created objective conditions and circumstances to move to socialism. In Romania, the industrial workers were almost nonexistent in contrast with the peasants, therefore there was no reason for the existence of a labor party. Romania was an agrarian country, and its social progress could not be achieved by establishing a rural democracy.

Ideologically speaking, Stere expressed his ideas using the term *poporanism* for the first time in 1893, in an article titled *Societățile și mișcarea națională [Societies and the National Movement]*, which was printed in *Evenimentul* newspaper (Ornea, 1989, p. 169-170). Poporanism became a current of social and economic thinking in which certain particularities of the economic state of Romania in contrast with the situation in the developed countries of Western Europe or that in Russia could be found. Stere emphasized the fact that, alongside accomplishing the agrarian reform, introducing the universal vote was the second major priority for poporanists, in order to eliminate the concentration of the political power in the hands of a minority "that, given its social status and this political privilege, rose above the law and has no interest in respecting it [...]". (Stere, 2023, p. 159)

2. Theoretical background

Writer, publicist and politician, Constantin Stere was the author of a vast and complex work, which has generated numerous analyses and critical comments both from his contemporaries, and from posterity as well. The first significant study on Constantin Stere's work and activity was written by Ștefan Voicu and was titled *Ideologia lui Constantin Stere [Constantin Stere's Ideology]* (1937). Of all the biographical works dedicated to Constantin Stere we only mention two: Zigu Ornea, *Viața lui Constantin Stere [The Life of Constantin Stere]* (1989 and 1991) and Iurie Colesnic, *Constantin Stere. O biografie [Constantin Stere. A Biography]* (2023). Zigu Ornea amply analyzed Constantin Stere's economic and social convictions in his works *Poporanismul [Poporanism]* (1972), *Țărănismul. Studiu Sociologic [Peasantism. Sociologic Study]* (1969) and *Studii și cercetări [Studies and Research]* (1972). He also authored the introductory study to the volume *C. Stere, Scrieri [C. Stere, Writings]* (1979). Ștefania Mihăilescu, in her book *Poporanismul și mișcarea socialisă din România [Poporanism and the Social Movement in Romania]* (1988) presented a series of considerations on Constantin Stere's economic thinking, but from the distorted perspective of the communist ideology. The same perspective on Constantin Stere's agrarian ideology was used by Olga Constantinescu in *Critica teoriei România, țară eminentamente agricolă [Criticism of the Theory Romania, a Completely Agrarian Country]* (1973). We can find more objective thoughts from a scientific, historical and contextual point of view on Stere's ideology in the following: Alin Dohotaru, *Socialiștii. O moștenire (1835-1921) [Socialists. A Heritage (1835-1921)]* (2019), Antoine Roger, *Fasciști, comuniști și țărani. Sociologia mobilizărilor identitare românești (1921-1989) [Fascists, Communists and Peasants. The Sociology of the Romanian Identity Mobilizations (1921-1989)]* (2012) and Robert Adam, *Două veacuri de populism românesc [Two Centuries of Romanian Populism]* (2018). Stere's populist view was explained by Victor Rădescu in the foreword of the volume *Constantin Stere. Scrieri politice și filozofice [Constantin Stere. Political and Philosophical Writings]* (2005). Among the sociology papers that approach Constantin Stere's works, we mention the one written by Ilie Bădescu, *Enciclopedia gândirii sociologice. Vol II. Teorii sociologice contemporane [The Encyclopedia of Sociologic Thought. Contemporary Sociological Theories, vol. II]* (2016).

3. Research methodology

In our approach in this paper, in order to extract, analyze and interpret Constantin Stere's economic ideology we did quality research on his extensive works and the works of all those who were interested in his views at different moments in time. We also had to carry out descriptive research and observe how Stere's ideas impacted the Romanian society back in his times and how they still kept their validity long after he was gone.

4. Findings

4.1. The Hot Money Theory

In his very first speech in the Parliament in December 1901, Constantin Stere tackled the issue of the origins and evolution of what is known today as hot money. Back then he called it "*capital vagabond*" (*wandering capital*) to designate foreign capital that migrated from economically developed countries toward backward countries: „wandering and cosmopolite capital, which tends to rule the world, imposing its will, from the stock market place, to the whole world”. (Stere, 2023, p. 60) In the second half of the 19th century, the developed countries had as their economic objective to ensure a trade surplus, to favor significant wealth accumulation. But, taking statistics into consideration, Stere discovered that instead given the developed countries showed a trend to maintain a trade deficit, and increase their wealth by placing enormous capital abroad: even though they imported more than they exported, they cashed more than they paid as the trade deficit was less important than the income brought by national capital invested in foreign countries. The trade deficit was by consequence second in importance as the balance of payments resulting from interests and dividends brought to the country by the capital that was invested abroad.

Stere's analysis became Marxist (even Leninist!) when he stated that peoples that import capital worked for the great economic powers (England, France, Germany, Holland). He mentioned John Stuart Mill and Henry Carey who looked upon capital invested abroad as true „war weapons”. England turned itself from the „world's workshop” into the “world's moneylender”. The interaction between the national and the foreign elements could generate dangerous effects for the development and the safety of a country such as Romania. The income of foreign capital did not favor the local industry, but rather the taking over of the natural resources by “a handful of people who do not know a people's aspirations and traditions” (op.cit., p. 65).

History has proven that developed countries have created their national industry solely on export while seeking for new external markets. Constantin Stere had his own view on establishing a new national industry using foreign capital in countries that imported, capital. He advocated for the priority development of the peasant industry, which did not require large amounts of capital.

Moreover, Constantin Stere pointed out the fact that political economy theorists based their doctrines upon partisan ideological ideas, taking into consideration the interests and the development stages of their counties: when these predominantly exported goods and merchandise, they focused on the benefits of a free trade economic policy, but when they started exporting capital, they emphasized the essential and dominant role of foreign capital in creating the big national industry!

Foreign (“vagabond - wandering”) capital has got a positive role as long as the added value, even though acquired by the capitalist (that is Marxist terminology!), stays within the country and as long as there is a growth of the national wealth. Thus, the domestic industry only seems to be prosperous, the only positive aspect being the portion that is received by workers as wages. Backward countries are being exploited by foreign capital, whereas in developed countries the industry advances even if the workers are being exploited (op.cit., p. 280).

Six years later, in the context of his debate with the socialists (especially with Constantin Dobrogeanu-Gherea), Stere published in *Viața românească* magazine (1907-1909) a series of articles titled *Social-democrație sau Poporanism? [Social-Democracy or Poporanism?]*. Here comes back in the spotlight the analysis of hot money or wandering capital as he called it – in Romanian it is “*capital vagabond*”: “a huge commercial capital and bank capital [...] wanders throughout the world in search of an advantageous placement, and its area of action includes especially the economically backward countries” (Stere, 1996, p. 116).

As far as the effects of hot money invested abroad upon the social progress in its country of origin is concerned, Stere quoted Kautsky: only industrial capital has a revolutionary economic and social role, as it develops production and brings about the existence of the working class, whose historical mission is to introduce the socialist means of production. Thus, in England, “exploiting backward countries leads to a delay in the social transformation of the country” (p. 119) in such a way that, even if the economic and social power of the capitalist bourgeoisie grows, the working class loses its power both from a quantity point of view (its percentage decreases), and from a quality point of view (the working class turns aristocratic, and it loses its revolutionary momentum because it becomes “satisfied with itself, and with its proprietors”(Stere, 2023, p. 119)

In conclusion, hot money has got an antirevolutionary character in the country where it comes from and, even though it makes the capitalist bourgeoisie strong, it weakens the working class and prevents social progress from taking place. (op.cit., p. 122)

4.2. The Agrarian Issue

Constantin Stere made a synthetic analysis of the Romanian agrarian system and noticed that it had an agrarian character due to the creation of the leaseholders' trusts: 3,5 million hectares were owned by more than 1 million peasant households, whereas 4 million hectares were owned by less than 1000 families (in other words, peasant ownership represented less than 42% of the area that was being farmed). (op.cit., p. 163).

Stere believed that the key of an agrarian system that was able to be the cornerstone of an optimal organization of the national labor was the fair proportion between the small and the large ownership in the field of agriculture. (op.cit., p. 161) He made a clear distinction between the “large ownership” and the “latifundia”. Stere knew well a lot of theoretic elements of political

economy, especially those applied in the field of agriculture: in this field, the production growth is less in comparison with the supplementary increase in labor and capital, in contrast with the industry, where this growth is superior to the additional input of labor and capital. (op.cit., p. 176) In this way, he did not dispute the economic need for the large ownership, respectively the creation of the leaseholders' trusts. There was a process of absorption of the middle ownership and fragmentation of the small ownership, which resulted in a drastic diminishing of the economic independence of the peasantry. In Stere's view, the legitimacy of the individual ownership (respectively of the large ownership) can only be given by conformity with the interests of social and national solidarity (op.cit., p. 109).

Constantin Stere presented the view of the German economist Gustav Schmoller who recommended that, in case of too high a percentage of the large ownership, the government, through its agrarian legislation and policy, should help the peasantry by giving them parts of the large ownership (op.cit., p. 162). Stere pointed to the need to make peasants owners of the land, because in this way the peasants would work for themselves instead of working for an income received from the landowner. The solution he envisaged: expropriation, since the government, as person under public law, cannot make transactions with private people. As a liberal, Stere considered ownership to be "sacred and intangible", but "nobody can have a right against the state's very conditions of existence, since the state is the only source of legal order" (op.cit., p. 168). Starting from Gustav Schmoller's statement, according to whom no revolution is inevitable as long as a reform takes place in due time, Stere considered expropriation as "a normal means of development under certain conditions", which can appear at a certain point in time as a necessity in the evolution of a state, a unique way to avoid "a violent transformation, a breakout of a revolution" (op.cit., p. 168).

As he was interested in not interrupting the normal historic development, Stere believed that the necessity of a political reform lies with the fact that, without it, the economic reform cannot take place, which in turn appears as a condition of the political reform's seriousness and sincerity. (op.cit., p. 170)

5. Conclusions

Constantin Stere explained the basics of the modern socialist outlook which, following social solidarity and national interest, postulates that the state must act in order to limit the social effects of individual selfishness. Nevertheless, just as he admits, Constantin Stere the politician was "deeply imbued with democratic ideology". His socialist views did not prevent him from considering that only a "democratic state structure" can ensure the balance of the social forces: "In a democratic country, the interests and aspirations of the different social categories are mirrored in the various political parties", and the political confrontation among these parties is the only way to avoid anarchy and civil war. (Stere, 2022, p. 479-480) The state has to fairly arbitrate the antagonistic interests within society, to pursue the strengthening of the national unity and of the social solidarity: patriotism must be the supreme moral value of the state's members and representatives! (Stere, 2023, p. 108)

The development of the national productive forces is indissolubly linked to the democratization of the state institutions: "only in a democratic country can the conditions for economic prosperity be met" (op.cit., p. 126). The cornerstone of prosperity is "a peasantry that is healthy, powerful, and has all its rights and interests properly defended" as there is a constant concern to respect the superior interests of the state (op.cit., p. 128)

As a poporanist, Constantin Stere placed the focus on the economic factor as the center of development and modernization, unlike the representatives of *semănătorism* and *junimism*, who placed the focus on the cultural factor. In his view, Romania did not have to follow the orthodox path of economic development (the one followed by every developed European country), but rather a path based on encouraging and supporting small independent peasant households.

Alongside the principles of *țărănism* stated by Virgil Madgearu, Stere's ideas will be the foundation of the vision to solve the agrarian issue that the Peasants' Party established in 1918 will put forward under Ion Mihalache's leadership.

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Beyond Monetary Policy: Expanding the Communication Frontiers of Central Banks

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Abstract

In a period marked by uncertainty, but also by rapid technological advances, communication is a fundamental element of a central bank's strategy. The outbreak of the global financial crisis paved the way for changes in central bank policy by expanding its role to maintain financial stability, not just price stability. Gradually, more and more issues outside the sphere of responsibility began to be addressed or even assimilated. In this framework, the paper aims to highlight the expanded role of a central bank's communication policy with the public, based on exploring the themes addressed in the central bankers' speeches, during 2015-2024. The analysis shows that the issue of financial inclusion is constantly discussed. Still, after 2019, speeches on climate change are comparatively more frequent. The subject remains open to in-depth explorations, in the context of increasing concerns related to changes in strategy and extended mandate.

Key words: communication tools, central bank mandate, public stability, financial inclusion, climate change

J.E.L. classification: D83, E58, E59, G53

1. Introduction

The succession of crises in the last two decades has created a special profile for the central bank, with its active involvement in ensuring financial stability by applying exceptional measures.

The communication policy of a central bank can be viewed as the spearhead for the messages developed and conveyed to address the uncertainty and concern exhibited by the public. In this context, the significant changes in the economy and society since the onset of the global financial crisis in 2007-2008 are inherently reflected in the formulation of the communication policy of a central bank, which has notably enhanced its openness to the public to achieve its monetary policy objectives, while also providing a framework for financial stability and a predictable outlook regarding inflation dynamics and monetary policy instruments (Criste and Lupu, 2017).

Beyond the motivations related to the responsibility assumed to achieve its monetary policy objectives, based on the formation of inflationary expectations, the improvement of investor sentiment and the reduction of uncertainty in the financial market, the central bank communicates with the public also to be connected to the current reality and to the problems of society, to identify the perception of the public, but also to form and familiarise it with the financial environment.

At the same time, central banks find it increasingly difficult to maintain their operating framework in their core competence, because under the pressure of the recent shocks and crises, more and more problems outside the sphere of responsibility have begun to be addressed and assimilated. Reporting on policies of broader interest in society, such as those in the field of climate change or those regarding the reduction of income inequality in the economy, is a concern increasingly present in public debates, thus referring to a potential expansion of the role of central banks in society.

The paper's objective is to highlight the importance that the central bank gives to current issues outside its responsibility. The theoretical framework of the problem is presented in the following section, identifying both the means of communication of a central bank with the public and the relationship between significant issues and financial stability. Next, in the third section, the working methodology is presented, based on which, in the fourth section, the research results are obtained and presented/described, identifying trends regarding the communication of central banks on extra-monetary issues. In the last section, the conclusion, some essential ideas that emerge from the paper are mentioned.

2. Theoretical background

2.1. Central bank and the current issues in society

Central banks have traditionally had a fundamental objective of price stability, but since the global financial crisis, many have expanded their mandate to include financial stability. At the same time, these institutions have become increasingly open to the public and concerned about broader societal issues, as they have direct or indirect implications for financial stability.

One of the topics for which there is growing interest is the role that central banks can play in addressing the risks associated with climate change, physical risks and the transition to a low-carbon economy. The motivations for such concerns at the level of central banks and the justification for their involvement in this area are given not only by the potential effects of climate change on the functioning of the financial system, but also by the importance of the central bank as an authority that can promote the idea of making this policy a government priority.

Clarifying the extent to which the central bank can act as a catalyst for promoting green financial development and incorporating climate change risks into its operational mechanism are relevant aspects that can redefine the mandate of a central bank. It can be considered that the relevance of the subject of climate change for the central bank was marked by the first speeches on this topic by two central bank governors – the governor of the central bank of Finland, Liikanen, in 2008, and the governor of the Bank of England, Carney, in 2015. The first drew attention to the risks of the effects of climate change on inflation dynamics and the formation of inflationary expectations, while the second expanded the scope of concerns and worries about the stability of the financial system, probably also as a result of the experience gained with the manifestation of the global financial crisis (Lupu and Criste, 2023).

Another relevant topic for the analysis concerns the issue of income distribution in the economy. Although it is outside the area of responsibility assumed by a central bank, in recent years, there has been an increase in concerns among decision-makers within central banks regarding the dynamics and trend of this phenomenon. The motivation for its importance is given by the manifestation of a double connection between monetary policy and income inequality: on the one hand, the efficiency of monetary policy is affected in more unequal societies (Kaplan et al., 2018; Awazu Pereira da Silva et al., 2022), and on the other hand, central bank decisions affect the distribution of income in the economy (Feiveson et al., 2020). Moreover, according to Awazu Pereira da Silva et al. (2022), conditions tend to worsen in economic recession, and recovery from the recession is slower.

Carstens (2021) argues that persistent and higher inequality should be seen as a characteristic of the environment in which the central bank must act to achieve its objective. Some studies show the different influence of monetary policy conduct on income inequality, depending on the level of inflation. Thus, Glawe and Wagner (2024) emphasise that a restrictive monetary policy conduct can reduce inequality in the long run in countries characterised by high inflation, while in countries with low inflation, such conduct can accentuate the inflation-unemployment dilemma, amplifying the phenomenon of inequality. The complex interaction between central bank policy and income inequality in the economy demonstrates the importance of this phenomenon for the monetary authority.

The issue of financial inclusion, with its two dimensions, access to financial education and access to financial services, is already integrated into the concerns of many central banks, given that it has implications for financial stability. Thus, access to financial services means diversifying

financial risks, strengthening the banking system based on stable sources of financing provided by savings banking services offered to the population, access to loans, etc. However, capitalising on these advantages automatically implies knowledge and understanding by the public of the financial services they can benefit from. Therefore, financial education can improve the capacity to make informed financial decisions.

2.3. Ways of communicating with the public

Traditionally, the communication policy of a central bank connects with the public, as the recipient of the central bank's messages, whether it is about communicating its objective and strategy, the monetary policy decisions adopted and their motivation or informing about forecasts on the dynamics of the economy or the trajectory of the monetary policy interest rate. Effective communication from the central bank means clarity in transmitting messages to the public (Blinder et al., 2008). Still, at the same time, it requires support from the public to achieve its objectives.

Kryvtsov and Petersen (2021) underline the stabilising effect of central bank communication on individual and aggregate outcomes, and the effect size varies depending on the type of communication. It is no longer aimed only at professional or financial specialists, but also at the public.

Central banks have improved their communication strategies to interact more effectively with the public. These changes are based on both the development of new communication technologies and the observation that transparency and openness towards the general public contribute positively to institutional credibility. Moreover, in a knowledge-based society, central bank communication is essential for improving the public's financial and economic education, familiarising them with specialised terms. They use a variety of communication channels to convey their policies, decisions and economic perspectives, from press releases and official statements and specialised reports to messages and posts on social networks, with a character more accessible to the general public (see Table no. 1).

Table no. 1 The main communication channels of a modern central bank

WHICH channel	HOW acts	WHAT to convey
Official Statements and Press Releases	<i>announce...</i>	monetary policy decisions, interest rate changes, and economic forecasts.
Monetary Policy Reports and Research Papers	<i>publish...</i>	detailed documents that help explain monetary policy decisions and provide transparency.
Official Website	<i>post...</i>	information and data for easier and faster access by the general public.
Speeches and Public Statements	<i>deliver...</i>	messages for more in-depth information about monetary policy and economic conditions.
Press Conferences	<i>hold...</i>	conferences to clarify decisions for shaping public perception.
Media Interactions	<i>give...</i>	interviews to manage narratives and address concerns.
Social networks	<i>share...</i>	information on social media platforms as a way for the general public to access it quickly.

Source: authors' contribution

These channels can be ranked according to their degree of authority. The most relevant in this regard are official statements and reports, followed by press conferences and speeches, and finally, social networks and interactions with the media as additional tools. The first category is more technical, using specialised language applied to monetary policy issues. The second category is addressed to specialists and those in the academic world, as well as to a broader, non-specialist public. Therefore, the language is more nuanced and less specialised, without too many stereotypical and technical phrases, but the approach to the themes is also more extensive. The third category, which occupies an increasingly important place in general communication, developed in the context of the democratisation of information, is a more direct, addressed to a

large, non-specialised public. This category is most subject to interpretations that can be more easily visible in virtual space and generate faster and more volatile reactions in this environment.

A recent study (Choi and Asaju, 2024), which surveyed the communication strategy among 34 central banks, in the first part of 2024, mentions that these institutions continue to rely more on traditional communication means – the press (60.7%) than on social networks (39.3%), but many of them are considering improving their websites and increasing their presence on social networks in the future. In the future, artificial intelligence tools could support communicating with the public (both for formulating layered messages, by audience categories) and identifying public reactions to the central bank's message. Approaching the public using communication tools is achieved by pursuing at least three objectives:

- permanent information and timely reporting of new trends in the economy
- education and literacy in the field of finance
- listening to the public to gather information and identify perceptions.

New communication tools used by central banks to inform the public include using social media and digital platforms to share updates and explain monetary policy in simpler terms, as well as podcasts and live webinars that discuss economic trends and policy decisions in a more conversational format.

Public education in this area is achieved by developing user-friendly websites with explanatory videos, infographics, and frequently asked questions (FAQs) to help the public understand complex financial concepts. In this context, artificial intelligence tools, using chatbots, can be helpful by providing instant answers to frequently asked questions about monetary policy.

Some more advanced central banks (e.g. the Federal Reserve, European Central Bank, Bank of England, Bank of Canada) hold public listening events (e.g. Fed Listens, an series of events initiated by the Federal Reserve) to understand the concerns of the non-specialised public better and to identify perceptions/economic sentiment. All these tools aim to increase trust, improve financial literacy, and ensure that the public understands monetary policy decisions well.

3. Research methodology

In order to highlight the importance that the central bank gives to current issues that are outside its responsibility, we resort to a comparative analysis of the dynamics of certain extra-monetary issues addressed by central banks at the communication level. Three topics of analysis were selected, based on those stated in the second section, topics relevant to financial and monetary stability, which are increasingly present in society, and which are included in the official agenda of decision-makers: climate change, income inequality and financial inclusion (which involves both access to financial services and resources, as well as financial education).

Of the communication channels presented and ranked above according to authority, we will focus on speeches and interviews for the present study, starting from the premise that here the diversity of the topics addressed is more clearly reflected. They have a more general character, addressed to a broader audience, in an accessible language, adapted to the target audience. This type of communication is relevant because it is one of the main ways essential themes are communicated quickly and clearly, beyond those specific to central bank policy.

The analysis considered the sample speeches delivered by central bank officials, recorded by the Bank for International Settlements (BIS). The data and information are extracted for the period 2015-2024.

To filter the results, we resorted to searching the speeches for specific keywords for each theme, as follows:

- Climate change, global warming, carbon footprint, fossil fuel, renewable energy, and green finance.
- Income inequality, wage or income gap, income or earning disparity, wealth concentration, poverty, and minimum wage.
- Financial inclusion, digital financial services, financial or credit access, consumer protection, financial education or literacy, and financial knowledge.

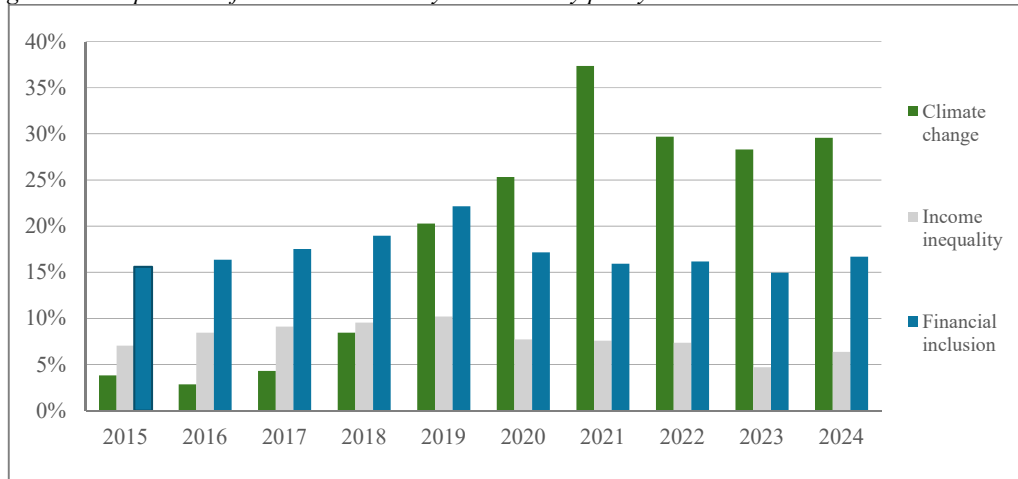
The data will be obtained based on the annual number of speeches on each selected theme and

the total number of speeches by central bank officials.

4. Findings

Based on the data processed and presented in the graph below (Figure 1), different developments can be noted regarding the three extra-monetary areas addressed by central banks from 2015 to 2024.

Figure no. 1. Speeches of central bankers beyond monetary policy



Source: authors' contribution based on data extracted from the BIS website, available at: www.bis.org/cbspeeches/index.htm?m=256

The central bankers' speeches on the topic of income inequality, although they do not have a significant share, being under 10% of all annual speeches, have a relatively constant trend over time.

It is worth noting that in the first part of the interval (2015-2018), a hierarchy of the three topics addressed is maintained, the field of financial inclusion being more frequently presented in speeches. It is a topic that the central bank treats with interest, through its involvement in financial education programs, but also through the effort to improve the population's access to financial services or through activities regarding consumer protection. After 2019, however, a change in the hierarchy occurred, considering the significant increase in speeches on climate change. In fact, since 2020, speeches on climate change have had the highest share in total, compared to the other two categories, reaching their maximum level in 2021. This trend confirms that central banks are among the most active actors in the public debate on climate change and the transition to low-carbon emissions.

It should be noted that the grouping into the three categories of topics has certain limits, considering that some keywords from a specific group can also be found in another group, because there are no clearly delimited boundaries, at least in terms of financial inclusion. It can be interpreted that financial inclusion is directly linked to the field of income inequality, given that the phenomenon of unequal income distribution influences the degree of poverty and implicitly makes the process of financial inclusion more complicated: the access to financial services is affected, as well as the access to education, including financial education. Another limit refers to the set of keywords used. Trying to limit ourselves to six relevant keywords for each field, there was a risk of losing other terms that may be equally relevant. However, the topic addressed remains open to research and in-depth study.

5. Conclusions

Beyond the motivations related to the responsibility assumed to achieve its monetary policy objectives, based on the formation of inflationary expectations, the improvement of investor sentiment and the reduction of uncertainty in the financial market, the central bank also communicates with the public to be connected to the current reality of the society, to identify the perception of the public, but also to guide and familiarise it with the financial environment.

The speeches on the three selected topics have different weights in the total of the annual speeches. An increase is particularly noticeable in addressing the climate change problem and the greening economy.

It is reconfirmed that the speech remains one of the main channels of communication on current economic and societal issues, which go beyond the specific spectrum of monetary policy and decisions of this kind. They have the role of signalling the central bank's presence as an important actor in the economy, connected to social problems.

The limits of the research regarding the relativity of the grouping into the three categories of subjects or the set of keywords used could be considered motivations for developing and extending the subject through in-depth explorations. This represents a topical issue in the context of increasing concerns related to changes in strategy and the potential expansion of the central bank's mandate, in general, with the possibility of refinement through the use of more rigorous analysis techniques.

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Tourism Demand - Primary Factor of the Tourism Services Market

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Abstract

The demand for tourism services is essential and defining in the tourism services market, because the tourism motivations that underlie the formation of demand for tourism services determine the tourism supply and, consequently, the production of tourism services.

The demand for tourism services is the primary factor determining tourism activity for transportation services, accommodation services, restaurant services, leisure services, as well as for travel agencies that organize tourism service packages.

This paper focuses on the demand for tourism services as a primary factor in the tourism services market and analyzes the factors that determine it.

Key words: tourist demand, tourist market, tourist services

J.E.L. classification: L80, L83

1. Introduction

In order to penetrate the tourism services market, tourism service providers must first consider the demand for tourism services, starting from the needs of tourists, needs that express tourism motivations and generate the forms in which tourism manifests itself.

The demand for tourism services is influenced by numerous economic, social, legislative, political, and health factors, which makes it complex, diversified, and heterogeneous, with numerous implications for suppliers in this market.

2. Theoretical background

Tourism demand is defined by the number of tourists and can be either actual or potential. (Medlik, 1993, p.45). In other words, under the influence of certain factors, such as tourist service prices, disposable income, and free time, demand can become real, effective demand, and the number of tourists can increase. Effective demand is more than just the wanting of something, but is defined as demand backed by cash (Tribe, 1999, p.47). This statement suggests that the effective or solvent demand for tourism services is what is transformed into tourism consumption and generates tourism production.

The factors that determine a traveller's choice of destination and accommodation will depend on the purpose of the trip (Foster, 1985, p.33). From this, it can be seen that the demand for tourism services for a particular destination is formed on the basis of the tourist motivations that determine a person to travel and consume the purchased tourism services. The motivation of the individual person to travel is produced not so much by an innate impulse, but develops primarily under the influence of the social environment, from which every individual draws his norms (Krippendorff, 1987,p.17).

Although tourist motivation has an individual, personal character, it is influenced by the social, cultural and economic environment in which a person lives, and consequently the demand for tourist services is shaped by the action of these factors. The choice of any destination is also a consequence of tourists' increasing awareness of travel opportunities resulting from improved educational provision and modern mass media interest in foreign countries, their natural features and cultural traditions (Laws, 1991, p.16). These factors determine the demand for tourist services

at the international level and consequently the development of the world tourist market. Segmentation of tourists into specific categories with homogeneous desires will become more and more important for regional tourism organizations and the tourism industry at large (Heath *et al*, 1992, p.92).

Depending on the number and size of market segments, either a concentrated strategy is adopted by which the same tourism product is offered, or a differentiated strategy by which tourism services are differentiated according to the characteristics of demand. (Stancioiu, 20024, p.54). In other words, although tourist motivations are heterogeneous, which gives tourist demand a diversified, complex, and heterogeneous character, in the tourist market, tourist service providers seek to homogenize tourist demand in order to standardize tourist services and increase the degree of satisfaction of tourist demand, implicitly increasing the efficiency of tourist services.

The demand for tourism services is determined by a number of factors that tourism service providers must take into account, namely: tourist income, the price of tourism services, the price of goods and public services, tourism regulations, natural, demographic, social, cultural, religious, and psychological factors, leisure time, tourism motivations, competition and value for money, seasonality, and state intervention in the tourism market to stimulate demand for tourism services for different forms of tourism.

3. Research methodology

The analysis of demand for tourism services primarily involves a conceptual approach, as the tourism services market has certain characteristics that distinguish it from the demand for tangible products.

At the same time, analyzing it requires studying the factors that determine it, with statistical analysis being the main method for identifying the trends and causes that have determined demand in the Romanian tourism services market.

4. Findings

In Romania, demand for tourism services has evolved differently depending on the types of tourism practiced and the tourist destinations. Although the tourism services market in Romania is a market in which competition must be free, it is a highly regulated market with the aim of protecting tourism consumers but also facilitating state intervention in order to develop domestic tourism by stimulating demand for tourism services and, consequently, tourism consumption.

While demand for tourist services is highly elastic, changing according to price, disposable income, and available time, the tourist offer is rigid because it depends on natural resources, the technical and material basis of tourism, and the facilities and services offered by providers in the tourist market. In addition, for different forms of tourism (e.g., seaside tourism or white tourism), due to the pronounced seasonality, tourism service providers act as if they were a monopoly, charging very high prices for the services they offer, prices that are not related to quality or cost structure, but to obtaining high profits in a short period of time.

Because, in many situations, for different forms of tourism and in different tourist destinations, the quality-price ratio is not commensurate with the services required, this leads to a high degree of dissatisfaction and, consequently, to the redirection of tourist flows to other tourist destinations, especially to tourist destinations outside Romania.

Seasonality is one of the main factors influencing the demand for tourism services. It can be caused by natural factors related to climate, or by the periodicity of events such as festivals. Seasonality can also be determined by regulations regarding the duration of leisure time (leaves, vacations, public holidays), with positive or negative implications for the demand for tourism services. Thus, in Romania, the restructuring of the school year by granting modular vacations distributed throughout the school year has led to an increase in demand for tourism services throughout the year and a reduction in congestion during the season, in the case of snow tourism, thus enabling tourism service providers to make the most efficient use of accommodation capacity and related services.

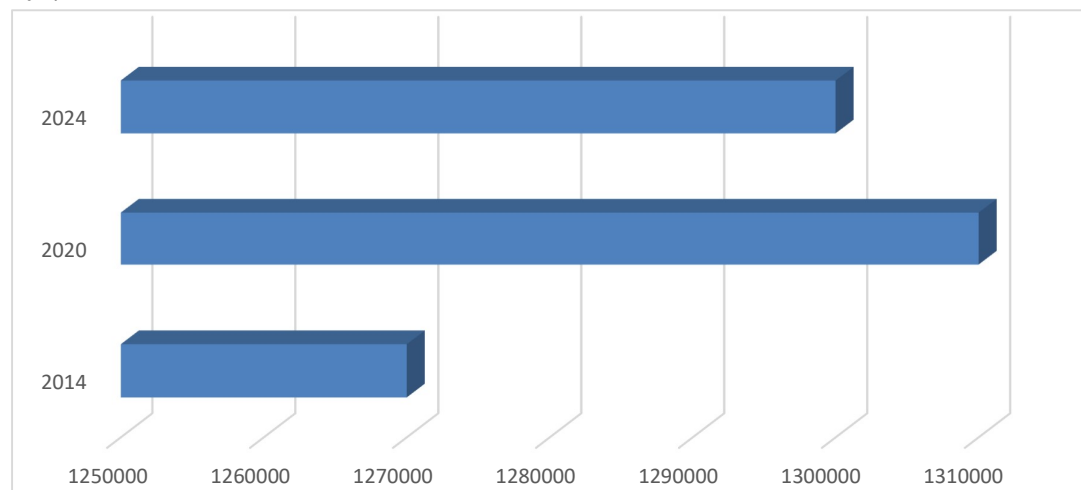
In Romania, tourist demand has also been influenced by other factors, among which economic factors have had a particular impact on the tourist market, primarily on the demand for tourist services, but also on tourist service providers.

An important role in increasing the demand for tourism services in Romania was played by state intervention in the tourism market to directly stimulate demand for tourism services and, in this way, tourism service providers.

This intervention in the demand for tourism services was achieved by offering holiday vouchers. Holiday vouchers are sums of money granted from the state budget to employees in the public sector. These sums were initially granted in the form of vouchers with the value printed on them, and were later granted electronically using a card. These vouchers were introduced in 2009 as a result of the economic and financial crisis that affected the purchasing power of employees and, consequently, the hospitality industry in Romania. The granting of holiday vouchers is a real example of state intervention in the tourism market, a market which, although it should be subject to the competitive rules of the market economy, is a highly regulated market and, in such situations, functions artificially, because once the economic and financial crisis passed, the state has continued to grant holiday vouchers instead of investing the respective amounts in general infrastructure or in tourism infrastructure owned by the state and offering tourist services at reduced prices, which would protect tourists with low incomes.

This intervention by the state in the tourism market is highlighted by the number of public sector employees who have benefited from holiday vouchers since 2009 (see Figure 1).

Figure no. 1. Evolution of the number of employees in the public sector in Romania, between 2014 and 2024



Source: (www.insse.ro; Financial Newspaper, <https://www.zf.ro>)

Analysis of the data in Figure 1 indicates the following aspects:

- The number of employees in the public sector in Romania is high, which requires considerable funding from the state budget.
- While in 2014 the number of these employees was 1,270,000, in 2020 it increased to 1,310,000, representing a 3.2% increase
- In 2024, there were around 1,300,000 employees in the public sector, which is still a high number. Even though it decreased by 10,000 employees in 2024 compared to 2020 as a result of the COVID crisis, it is still 30,000 employees higher in 2024 than in 2014.
- The analysis of this data is very important because it highlights the state's intervention on the demand for tourism services in Romania, with beneficial implications for tourism service providers in terms of revenue. Thus, the granting of holiday vouchers to 1.3 million public sector employees has led to an increase in the number of tourists in Romania, and implicitly in the amounts collected by service providers in the tourism market. The amounts allocated from the state budget in the form of holiday vouchers can be used both for the purchase of services taken separately by the tourist,

i.e. for transport services, accommodation services, catering services, leisure and entertainment services, provided that at least one night's accommodation is purchased, or they can be used to purchase a package of tourist services from a travel agency, but only for the purchase and consumption of these tourist services on the Romanian domestic market.

The granting of holiday vouchers to public sector employees in Romania, as a means of state intervention in the Romanian domestic market, has, in my personal opinion, generated certain advantages and disadvantages.

Advantages generated by granting holiday vouchers in Romania:

- Increasing demand for tourism services by using funds allocated from the state budget to public sector employees

- An annual increase in the number of tourists by at least 1.3 million people, or a doubling, perhaps even tripling of this number if we consider that the beneficiaries of holiday vouchers traveled with their families

- Limiting the negative effects of the economic and financial crisis of 2009-2011, due to the decline in the purchasing power of the population as a result of rising prices and falling incomes, the granting of these holiday vouchers being a way of satisfying tourist motivations in times of crisis

- Creating the possibility for people employed in the public sector to enjoy a holiday, given that during the economic and financial crisis of 2009, public sector salaries were cut by 25% and accompanied by a decline in purchasing power, which drastically reduced the income available to satisfy tourist motivations. Under these circumstances, the granting of holiday vouchers was seen as compensation for the reduction in income in order to increase tourist demand.

- The granting of these holiday vouchers was initiated as a measure that would not lead to an increase in inflation, by providing a means of payment for tourist services rather than directly granting sums of money that could be spent on other goods outside the tourist market rather than on tourist services such as transport, accommodation, meals, and leisure activities. In this way, both the demand for tourist services and the supply of tourist services on the Romanian domestic market were supported, thus protecting and developing domestic tourism

- Supporting tourism service providers in the Romanian hospitality industry by stimulating tourist demand and thus triggering tourism production and consumption

- Protecting the domestic tourism market in Romania, as the amounts granted in the form of holiday vouchers could and can only be used for domestic tourism and not for international tourism

- Ensuring a degree of security in terms of revenue for domestic tourism providers and intermediaries, regardless of the form of tourism practiced

- Preventing a reduction in tourism employment and, implicitly, an increase in unemployment as a result of reduced demand for tourism services

- Ensuring a constant level of occupancy for providers in the hospitality sector as a result of the annual granting of holiday vouchers

- Spending part of a person's or family's own income in addition to the amount granted by the state in the form of holiday vouchers, for transportation services, meals, leisure activities, visiting tourist attractions, amounts of money that take the form of income for tourism service providers in Romania, which represents an injection of money into the domestic tourism market from the population's savings, to the benefit of providers of domestic tourism in Romania.

Disadvantages of granting holiday vouchers in Romania:

- The use of holiday vouchers since 2009 to stimulate demand for tourism services has had a negative effect on tourists as consumers, whether or not they are beneficiaries of holiday vouchers, namely an increase in the prices of accommodation and related services, with prices doubling in a very short time and then continuing to rise for these tourist services, as well as for tourist service packages offered by travel agencies. As such, what was initially considered to have a positive effect on tourists has in fact had a negative impact on consumers of tourist services and only a positive impact on tourism providers in terms of revenue generated

- The need to allocate part of a person's or family's own income, in addition to the amount granted by the state in the form of holiday vouchers, because this amount is insufficient for a family to spend a holiday, as the cost of tourist services requires a much higher amount than that

given in the form of a tourist voucher.

- Granting long-term holiday vouchers is not beneficial for tourists, tourism providers, the tourism market as a whole, or the state budget.
- By granting holiday vouchers, the demand for tourism services is negatively affected because, although in the short term it generates an increase in demand for tourism services, in reality it represents an artificial increase in demand, by transferring significant amounts of money from the state budget to the budgets of tourism service providers, without these providers making any effort to attract these amounts by stimulating tourism demand
- Tourists' dependence on domestic tourism, because the amounts granted in the form of holiday vouchers can only be used for domestic tourism. Under these conditions, tourists lose the opportunity to spend a vacation in a tourist destination other than Romania, especially when they need to supplement the amount with their own income, because the amount granted in the form of a holiday voucher is insufficient to spend a vacation in decent conditions.
- It creates a feeling of discrimination among employees in the private sector, who do not receive holiday vouchers from the state budget but who contribute to state revenues by paying taxes and fees.
- It limits tourists' freedom of choice and forces them to consume tourism services within a certain period of time and in a certain area, which puts pressure on individuals to obtain tourist status and use their holiday vouchers under threat of losing the amount in question.
- The granting of holiday vouchers generates a hidden form of social tourism and transforms public sector employees into social welfare recipients in terms of tourism, with a major psychological impact on tourist behaviour, by reducing their self-confidence as subjects of tourism based on holiday vouchers, a form of social tourism that has become mass tourism.
- Decreased free competition between tourism service providers on the Romanian domestic market and reduced interest in improving the quality of services offered and investing in technical and material resources as a result of the certainty of constant annual revenue from tourists benefiting from holiday vouchers
- Decreased interest among service providers in diversifying their service offerings, improving value for money, and finding strategies to attract both domestic and international tourists. This is due to the security enjoyed by tourism service providers and intermediaries through the annual guarantee of the number of tourists benefiting from the amounts allocated from the state budget in the form of holiday vouchers.
- The psychological impact on tourism service providers by creating the idea that we are not in a market economy where suppliers must make every effort to attract tourist flows and that the state is obliged to ensure them a secure level of income by granting these holiday vouchers. This creates the idea that the lack of these funds from the state budget will lead to a collapse in the hospitality industry, which is not true, because providers must find strategies to attract tourists and adapt their profits to the costs incurred, rather than maximising profits in a very short time by charging high rates under the umbrella of holiday vouchers.
- The lack of interest on the part of service providers in providing quality services to tourists benefiting from holiday vouchers and the discriminatory treatment to which these tourists are subjected compared to international tourists or tourists who pay for tourist services out of their own pockets. Thus, in many cases, tourists who pay with holiday vouchers are treated inappropriately, often humiliated by the lack of professionalism of tourist service providers, due to the idea that regardless of the quality of the tourist service, these tourists have no choice but to spend this money, and providers thus have a guaranteed income regardless of their behavior towards tourists. These tourists are treated as if they are receiving these services from providers as charity, with their status as welfare recipients in tourism thus having a huge negative impact on them
- Holiday vouchers have led to dual professional behavior on the part of service providers in terms of tourism, which profoundly affects the free functioning of the tourism market
- Although state intervention in the tourism market through the provision of holiday vouchers is beneficial in the short term, in the long term such intervention is not beneficial as it generates more negative than positive effects. The respective amounts can be invested in the real economy by creating general infrastructure, modernising resorts and treatment facilities so that tourists can

benefit from low-cost, high-quality services and can purchase the tourist services they want with the income obtained from their work, either on the domestic or foreign market, according to their own tourist motivations, when they want and where they want, and not forced and constrained to consume the amounts allocated by the state through holiday vouchers.

5. Conclusion

The demand for tourism services is a key factor in the tourism market. It is determined by numerous economic, social, cultural, political, religious, legislative, and natural factors that can influence it positively or negatively. Although demand for tourism services is the primary factor in the tourism market, tourism supply should not be left behind, but should meet tourism demand in order to satisfy it as efficiently as possible.

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Geopolitical Risk and Economic Policy Uncertainty: A Regime-Dependent VAR Analysis

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Abstract

This paper investigates the dynamic relationship between global economic policy uncertainty (GPU) and geopolitical risk (GPR) over the period 1997–2025. Utilizing monthly data from the Global Economic Policy Uncertainty Index and the Geopolitical Risk Index, we estimate both a linear vector autoregression (VAR) and a nonlinear threshold VAR (TVAR) model to capture potential regime-dependent dynamics. The empirical findings reveal strong asymmetries in the transmission of uncertainty shocks. In tranquil periods, shocks to the GPU exert limited influence on GPR, and vice versa. However, during high-risk geopolitical regimes, policy uncertainty shocks significantly amplify geopolitical tensions, while geopolitical shocks lead to persistent increases in economic policy uncertainty. These results underscore the importance of accounting for nonlinearities and regime shifts when modelling uncertainty interdependence. Our findings contribute to a better understanding of how uncertainty propagates through the global system and offer important implications for policy design and risk management under conditions of elevated geopolitical stress.

Key words: geopolitical risk, economic policy uncertainty, threshold VAR (TVAR) model, regime-dependent dynamics

J.E.L. classification: C32, E66, F50, D80

1. Introduction

Periods of heightened uncertainty, whether stemming from economic policy decisions or geopolitical events, have increasingly defined the global macroeconomic landscape. From the aftermath of the 2008 global financial crisis to the disruptions triggered by the COVID-19 pandemic and ongoing geopolitical tensions, uncertainty has emerged as a powerful driver of financial market volatility, investment behaviour, and macroeconomic outcomes. Two categories stand out among the multiple sources of uncertainty: economic policy uncertainty (EPU) and geopolitical risk (GPR). While both have been studied extensively in isolation, their interaction remains relatively underexplored, particularly the potential bidirectional and regime-dependent dynamics between them.

The literature has established that economic policy uncertainty broadly affects firm-level investment (Baker, Bloom and Davis, 2016), stock returns (Bossman, Gubareva and Teplova, 2023), and macroeconomic activity. Simultaneously, geopolitical risk has been shown to trigger capital outflows, depress consumption, and elevate financial volatility (Caldara and Iacoviello, 2022). The relationship between geopolitical risk and economic policy uncertainty is characterised by intricate interdependencies. Escalations in geopolitical tensions can doubt the credibility and direction of future policy measures, while volatile or opaque economic policymaking may aggravate geopolitical instability, especially in vulnerable regions. Gaining insight into the mutual reinforcement of these two forms of uncertainty is strategically important for policymakers, financial actors, and risk management practitioners.

This paper contributes to the growing literature on uncertainty by empirically examining the dynamic relationship between global economic policy uncertainty (GPU) and GPR over the period 1997–2025. We use the GPR index developed by (Caldara and Iacoviello, 2022) and the GPU index by (Baker, Bloom and Davis, 2016) to capture fluctuations in global uncertainty. Our empirical strategy relies on a combination of a linear vector autoregression (VAR) and a nonlinear threshold VAR (TVAR) framework, allowing us to assess how the transmission mechanisms differ across low-risk and high-risk regimes.

The results reveal pronounced asymmetries: during geopolitical calm periods, GPU shocks have limited effects on GPR. However, in high-risk regimes, GPU shocks generate significant feedback into GPR, and vice versa. These findings underscore the importance of accounting for nonlinear and regime-dependent interactions in uncertainty modelling. They also carry important policy implications: in environments already characterised by geopolitical stress, unclear or unstable economic policies may exacerbate volatility, undermining investor confidence and global stability.

The remainder of this paper is structured as follows. Section 2 describes the theoretical background, Section 3 presents data and methodology, including the sources, transformations, and econometric framework. Section 4 presents the empirical results, including baseline and regime-specific impulse response functions. Section 5 concludes with key insights, policy implications, and avenues for future research.

2. Theoretical background

The relationship between EPU and GPR has garnered significant attention in recent years, particularly in their combined impact on macroeconomic stability and financial markets. The foundational work by Baker, Bloom and Davis (2016) introduced the EPU index, which provides a quantitative measure of policy-related economic uncertainty. Concurrently, Caldara and Iacoviello (2022) developed the GPR index, which captures the frequency of news articles related to geopolitical tensions and conflicts.

Several studies have explored the individual and joint effects of EPU and GPR on various economic indicators. For instance, Arif, Rawat and Shahbaz (2020) examined the impact of U.S. EPU on GPR in BRIC economies, revealing heterogeneous effects across countries. Their findings suggest that while U.S. policy uncertainty negatively influences GPR in China and Russia, it has a positive relationship with GPR in India and Brazil, indicating the complexity of cross-country spillovers. Studies have shown, for example, that the transmission mechanisms between GPU and GPR can differ significantly between low-risk and high-risk periods, emphasizing the need for models that account for such nonlinearities.

In the financial domain, Bossman, Gubareva and Teplova (2023) investigated the asymmetric effects of EPU, GPR, and market sentiment on European Union sectoral stocks. Utilising quantile-based techniques, they found that EPU from the European Union has the highest predictive ability on European Union sectoral stock returns, while U.S. EPU shows no significant predictive power. Their study underscores the importance of regional factors in determining the influence of policy uncertainty and geopolitical risks on financial markets. Environmental considerations have also been linked to EPU and GPR. Anser et al. (2021) analyzed the effects of these uncertainties on environmental degradation in emerging economies. Their research indicates that both EPU and GPR contribute to increased CO₂ emissions, highlighting the broader implications of policy and geopolitical uncertainties beyond economic and financial spheres.

Methodologically, various approaches have been employed to capture the dynamic interactions between GPU and GPR. Using vector autoregression (VAR) and threshold VAR (TVAR) models, firstly proposed by Antonakakis and Gabauer (2017), allows for examining regime-dependent relationships (Chirilă and Chirilă, 2022). Different types of VAR methodologies were used to analyse uncertainty in respect with different other economic indicators (Balcilar et al., 2021; Yang et al., 2022; Lopes and and Rotatori Corrêa, 2023; Hurduzeu et al., 2024).

3. Research methodology

This study employs two primary macro-financial indices to investigate the interaction between economic policy uncertainty and geopolitical risk (data source Economic Policy Uncertainty, 2025). The GPR Index, developed by Caldara and Iacoviello (2022), measures global geopolitical tensions, capturing the frequency of news-based references to geopolitical events. The GPR index is available at a daily frequency and was retrieved in May 2025. The GPU Index, constructed by Baker, Bloom and Davis (2016), reflects global economic policy uncertainty and is published at a monthly frequency. The sample period spans from May 1997 to April 2025, yielding 373 monthly observations.

To ensure temporal consistency, the daily GPR index is aggregated to a monthly frequency via a simple arithmetic mean, preserving the richness of high-frequency information while maintaining compatibility with the monthly GPU series. The aggregation is formalized as:

$$GPR_t = \frac{1}{D_t} \sum_{d=1}^{D_t} GPRD_{t,d},$$

where D_t denotes the number of trading days in the month t . Additionally, GPU values, initially reported at the beginning of each month, are temporally realigned to end-of-month timestamps to synchronise with the monthly GPR aggregates.

GPR and GPU indices are standardised to facilitate meaningful comparison between the two series (z-scores). While unit root tests using the Augmented Dickey–Fuller (ADF) procedure suggest that both series are non-stationary in levels but stationary in first differences, the empirical analysis proceeds using level data. This decision is grounded in two considerations: (i) the potential existence of a cointegrating relationship between the indices, and (ii) the robustness of impulse-response analysis to near-unit-root behaviour. A preliminary graphical inspection reveals asynchronous spikes in the two series, hinting at potential regime-dependent dynamics.

The analysis adopts a regime-switching approach to capture potential nonlinearities in the relationship between economic policy uncertainty and geopolitical risk. High-risk and low-risk regimes are defined using a threshold rule based on the empirical distribution of the GPR index. Specifically, months where GPR exceeds its 75th percentile are classified as high-risk:

$$HighRisk_t = \begin{cases} 1, & \text{if } GPR_t > Q_{0.75}(GPR) \\ 0, & \text{otherwise} \end{cases}$$

This classification yields 93 high-risk months (approximately 25%) and 280 low-risk months (approximately 75%). Sensitivity analyses employing alternative thresholds at the 70th and 80th percentiles confirm the robustness of this regime definition.

To model the dynamic relationship between economic policy uncertainty and geopolitical risk, the analysis begins with a standard vector autoregression (VAR) framework. Let:

$$\mathbf{y}_t = \begin{bmatrix} GPU_t \\ GPR_t \end{bmatrix}.$$

The baseline VAR(p) model is specified as:

$$\mathbf{y}_t = \mathbf{c} + A_1 \mathbf{y}_{t-1} + \dots + A_p \mathbf{y}_{t-p} + \boldsymbol{\varepsilon}_t, \quad \boldsymbol{\varepsilon}_t \sim \mathcal{N}(0, \Sigma).$$

Lag order selection using the Akaike Information Criterion (AIC) suggests an optimal lag length of $p = 2$.

To accommodate regime-specific dynamics, the baseline VAR is extended into a Threshold VAR (TVAR), where model parameters vary by regime according to the high-risk indicator:

$$\mathbf{y}_t = [\mathbf{c}^{(L)} + A^{(L)}(L)\mathbf{y}_{t-1}](1 - HighRisk_t) + [\mathbf{c}^{(H)} + A^{(H)}(L)\mathbf{y}_{t-1}]HighRisk_t + \boldsymbol{\varepsilon}_t.$$

Each regime-specific system is estimated using ordinary least squares (OLS), maintaining the two-lag structure for comparability. Coefficient differences between regimes are evaluated using Wald tests with heteroskedasticity-robust standard errors. Inference is based on 1,000 wild bootstrap replications.

Impulse response functions (IRFs) are computed separately for each regime over a 12-month horizon, with the regime indicator held constant throughout the simulation. Confidence intervals are constructed using 1,000 bootstrap samples.

As an additional robustness check, a Markov-Switching VAR (MS-VAR) model is estimated. Unlike the TVAR, this model allows regimes to emerge endogenously from the data. The smoothed regime probabilities obtained from the MS-VAR are compared against the externally defined high-risk regime indicator to assess model consistency and classification accuracy.

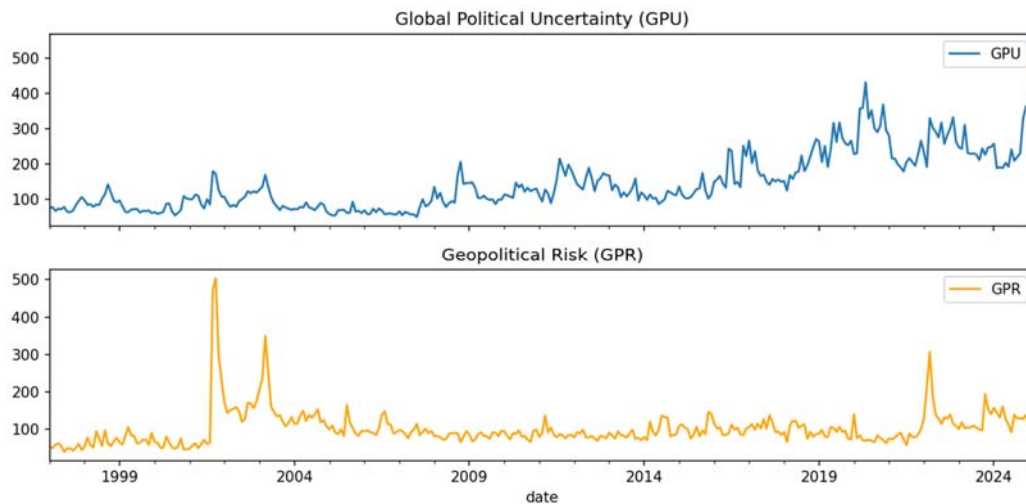
Four key considerations shape the methodological design of this study. First, aggregating daily GPR data to a monthly frequency ensures that the model incorporates high-resolution geopolitical information while remaining compatible with the lower-frequency GPU series. This mixed-frequency handling enables the capture of both short-term volatility and long-term trends in uncertainty dynamics. Second, by employing a Threshold VAR (TVAR) framework, the model can account for potential nonlinearities and asymmetries in the transmission of economic policy uncertainty across different levels of geopolitical risk. This is particularly important given the empirical observation that policy shocks may have varying effects depending on the prevailing risk environment. Third, based on a quantile threshold of the GPR index, the regime classification strategy provides a transparent and economically interpretable criterion for distinguishing between high- and low-risk periods. This threshold rule aligns with intuitive notions of geopolitical stress and enhances the clarity of the empirical setup. Finally, the chosen approach offers practical value for policy analysis: by identifying how the impact of economic policy uncertainty varies across geopolitical regimes, the model generates insights that are directly relevant for policymakers, investors, and risk managers seeking to navigate periods of elevated uncertainty.

4. Findings

Preliminary Dynamics

Figure no. 1 displays the GPU and GPR indexes' time series over the sample period from 1997 to 2025.

Figure no. 1. Evolving Patterns of Global Uncertainty: GPU and GPR from 1997 to 2025



Source: Authors' adaptation based on Economic Policy Uncertainty (2025)

While both indices capture distinct but interrelated dimensions of global uncertainty, their dynamics reveal important contrasts and interactions. The upper panel shows that GPU has experienced an upward trend, particularly since 2016, with a sharp escalation in the most recent period (2023–2025). This trend suggests a structural intensification of political and economic uncertainty at the global level, likely driven by events such as global financial crisis, Brexit, the COVID-19 pandemic, and the increasing fragmentation of global governance. The most recent surge likely reflects compounded crises, including geopolitical tensions, fiscal instability, and shifting policy frameworks in major economies. In contrast, the lower panel displays the GPR index, which is characterized by episodic spikes corresponding to major geopolitical events. Notable peaks include

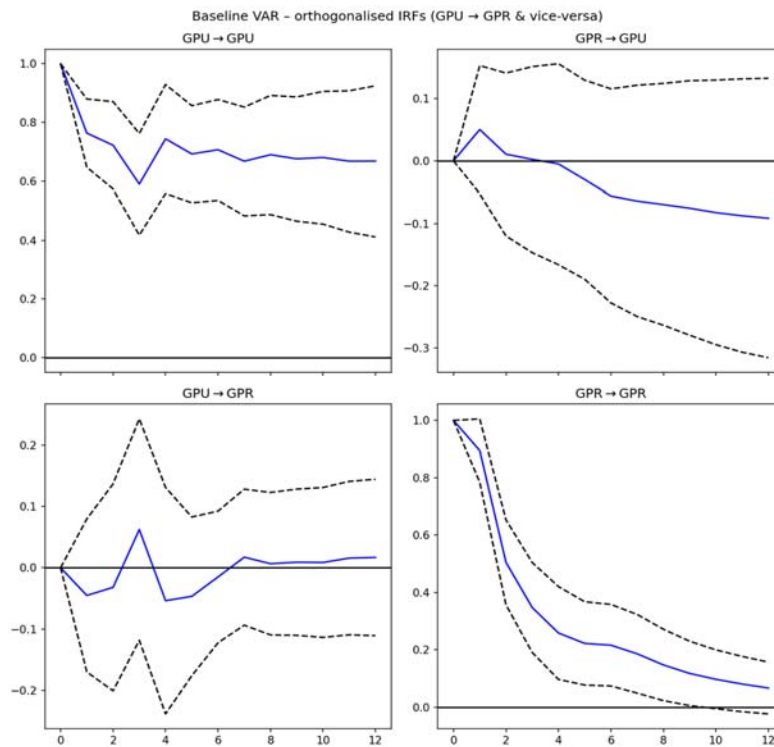
the September 11 attacks in 2001, the Iraq War in 2003, and the Russian invasion of Ukraine in 2022. While GPR does not exhibit a persistent trend over time, it reacts sharply to shocks, highlighting its sensitivity to international conflict, terrorism, and military escalation. A comparative reading of the two indices suggests that GPU reflects a broader, cumulative rise in systemic uncertainty, while GPR responds to acute geopolitical events. However, a stronger co-movement emerges in recent years, indicating a growing interdependence between political and geopolitical sources of uncertainty. This is particularly evident after 2022, when both indices increased in parallel, suggesting that global policy uncertainty and geopolitical tensions are becoming mutually reinforcing.

Baseline VAR Impulse Response Functions

Figure no. 2 presents orthogonalised impulse response functions (IRFs) from the baseline VAR(2) model. The top-left panel shows that a one-standard-deviation shock to GPU has a persistent, though declining, impact on itself, suggesting moderate inertia in policy uncertainty. The bottom-left panel shows the transmission from GPU to GPR, where the response is small and statistically insignificant, indicating weak direct transmission from policy to geopolitical uncertainty.

On the other hand, the top-right panel reveals that shocks to GPR exert a small but persistent adverse effect on GPU, suggesting that geopolitical tensions may dampen economic policy certainty over time. The bottom-right panel shows the autocorrelation of GPR itself, with a significant and long-lasting decline consistent with mean-reverting behaviour in geopolitical news flows.

Figure no. 2. Baseline VAR - Orthogonalised IRFs between GPU and GPR



Source: Authors' representation

Threshold VAR: Regime-Dependent Responses

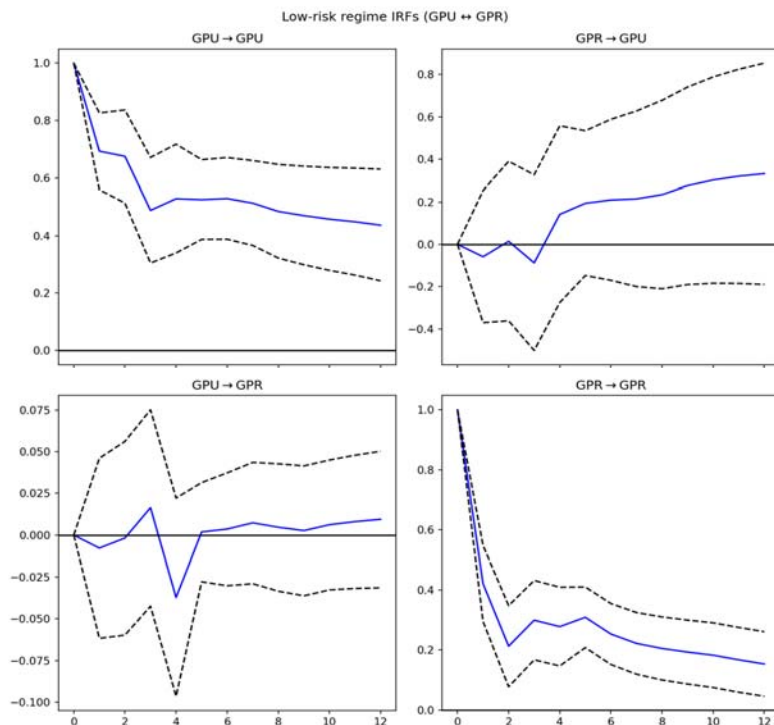
To explore whether the transmission mechanisms differ across risk environments, we estimate a TVAR model and compute regime-specific IRFs.

Figures no. 3 and 4 present the responses for the low-risk and high-risk regimes, respectively.

In the low-risk regime (Figure no. 3), shocks to GPU (top-left panel) have a relatively muted and decaying effect on themselves, while the bottom-left panel indicates that GPU shocks do not significantly affect GPR.

Notably, GPR shocks have a positive and gradually increasing effect on GPU (top-right), suggesting a weak transmission from geopolitical news to economic uncertainty in tranquil times.

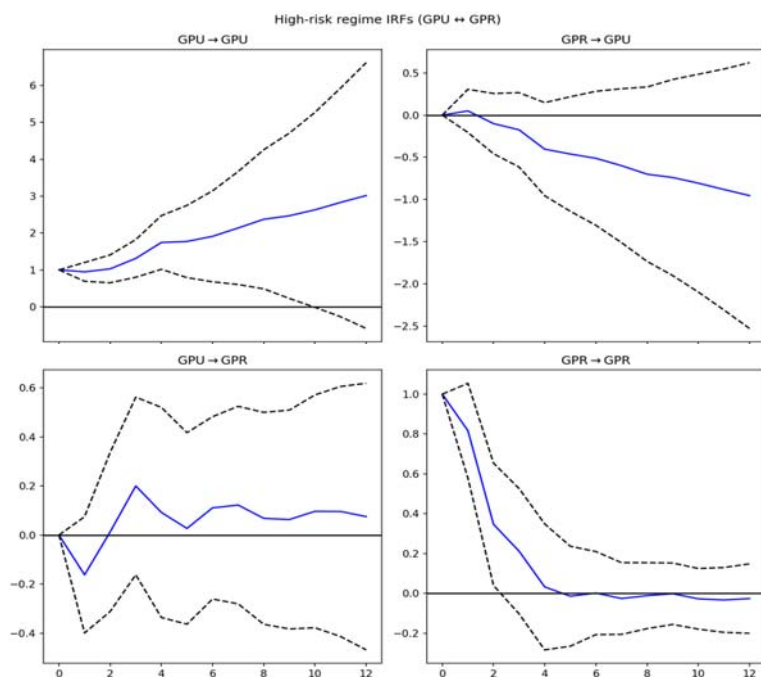
Figure no. 3. TVAR IRFs - Low-Risk Regime



Source: Authors' representation

Conversely, in the high-risk regime (Figure no. 4), the system behaves markedly differently.

Figure no. 4. TVAR IRFs - High-Risk Regime



Source: Authors' representation

A one-standard-deviation GPU shock produces a significant and growing effect on itself (top-left), indicating strong self-reinforcement of policy uncertainty in times of geopolitical stress. The bottom-left panel reveals that GPU shocks now have a sizable and positive effect on GPR, implying that economic policy uncertainty can exacerbate geopolitical instability in volatile environments. GPR shocks continue to exert an intense and persistent negative impact on GPU (top-right), consistent with expectations that heightened geopolitical tensions worsen economic policy clarity in crisis conditions. The bottom-right panel confirms the persistence of GPR in this regime as well.

These findings underscore the asymmetric interaction between economic policy uncertainty and geopolitical risk. While GPU shocks are largely inert or weakly transmitted under normal conditions, their effects are significantly amplified in periods of geopolitical tension. Similarly, GPR shocks have qualitatively different effects across regimes, with stronger feedback loops in the high-risk scenario. These results align with previous empirical findings that suggest nonlinear and regime-dependent propagation of uncertainty shocks. The TVAR structure thus proves critical in uncovering these dynamics, which would be obscured in a linear VAR. The contrast between the baseline model and the regime-specific responses illustrates the importance of accounting for nonlinearities in uncertainty interactions, particularly in contexts of heightened systemic risk.

5. Conclusions

This paper investigates the dynamic relationship between GPU and GPR using a combination of linear and nonlinear time series models from 1997 to 2025. By leveraging a baseline VAR and a TVAR framework, we uncover evidence of regime-dependent interactions obscured in linear models.

Our findings suggest that the transmission of uncertainty is highly sensitive to the geopolitical environment. In particular, GPU shocks exert minimal influence on GPR during tranquil periods, while their impact becomes statistically significant and economically large in high-risk regimes. Similarly, GPR shocks have asymmetric effects on GPU. During low-risk periods, geopolitical shocks contribute modestly to economic policy uncertainty, whereas they produce intense and persistent responses in high-risk periods. Impulse response analyses further support these nonlinear patterns, which reveal markedly different dynamics across regimes.

The results have important implications for both policymakers and financial market participants. From a policy perspective, the amplification of uncertainty in high-risk environments underscores the importance of coordinated responses during geopolitical crises. The finding that GPU feeds into GPR under such conditions suggests a potential feedback loop, whereby poorly communicated or unpredictable economic policy may exacerbate geopolitical instability. For investors, understanding the conditional impact of uncertainty shocks can improve risk management strategies, particularly in environments marked by elevated geopolitical tension.

Future research could extend this framework in several directions. First, incorporating additional variables, such as financial volatility indices or macroeconomic fundamentals, could help disentangle the channels through which uncertainty propagates. Second, examining cross-country heterogeneity using panel VAR or global VAR frameworks may reveal whether the observed dynamics are specific to the global level or driven by regional asymmetries. Finally, integrating structural identification schemes, such as sign restrictions or proxy SVAR methods, would enable a more precise interpretation of the shocks driving these interactions.

By revealing the conditional dynamics between geopolitical risk and economic policy uncertainty, this study advances the understanding of how uncertainty propagates under different regimes, underscoring the relevance of regime-sensitive modelling approaches in an increasingly volatile global environment.

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The Impact of Artificial Intelligence on Occupations Requiring Higher Education in Romania

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Abstract

The swift evolution of artificial intelligence (AI), especially in fields involving generative capabilities and automation processes, is significantly reshaping employment landscapes across the globe. This paper explores the economic ramifications of occupational shifts driven by AI, focusing on job displacement, changes in required skill sets, and the emergence of new occupational categories. Drawing upon conceptual frameworks and a comprehensive review of existing scholarship, this analysis outlines dominant paradigms of job substitution and complementarity, as well as the capacity of current labor regulations to accommodate such structural shifts. The evidence suggests that, although AI poses considerable risks to roles involving repetitive or routine activities, it also creates new opportunities for alternative employment models and increases the need for advanced digital proficiency. The study concludes by offering strategic recommendations for educational and economic reforms designed to support an equitable and responsive adaptation to an AI-influenced labor environment.

Key words: Digitalization, workplace transformation, workforce adaptation, digital skills

J.E.L. classification: E24, O11, O15, O30

1. Introduction

Artificial intelligence (AI) and its broader impact on global economies can be analyzed through various theoretical and empirical frameworks, each providing unique and critical perspectives. Among these perspectives, the effect of AI-driven innovations on labor structures emerges as one of the most crucial dimensions. Consequently, labor economics has become a focal point for research on automation, robotics, digital transformation, and other innovations shaping employment trends.

Since AI and related technologies can now replicate a broad array of tasks once carried out by humans, their widespread adoption may lead to notable disruptions within certain sectors. The anticipated influence of AI on employment is considerable, with the potential to displace specific roles while simultaneously fostering the emergence of new professions. However, this period of transition may pose serious challenges for employees, who may be required to undergo reskilling or upskilling to remain viable in an evolving job market.

A study conducted by McKinsey sought to estimate AI's broader economic effects on a global scale. Their projections suggest that, by 2030, AI could add approximately \$13 trillion to worldwide economic output, primarily through productivity improvements and associated mechanisms. Nonetheless, several barriers could decelerate the integration and diffusion of AI technologies. For instance, organizations that lag in AI adoption may struggle to develop necessary infrastructure or compete for skilled talent. Furthermore, the benefits and disruptions associated with AI are expected to vary across companies, employees, and national economies, making it more difficult to achieve equitable outcomes. Rather than progressing at a uniform pace, the influence of AI is likely to unfold

asymmetrically across regions and industries. In sum, while AI holds promise for enhancing global economic performance, realizing its full potential requires addressing structural disparities among workers, businesses, and countries.

As previously emphasized, one of the most profound aspects of artificial intelligence's economic influence lies in its relationship with labor markets. The implications of AI for employment are complex, presenting both significant obstacles and emerging possibilities. Automation has the potential to take over numerous occupational tasks, which could lead to workforce reductions in certain industries. At the same time, AI can augment job performance and generate entirely new occupational avenues. New professions linked to AI—such as developers of digital assistants, automation strategy experts, and marketing analysts utilizing AI technologies—are anticipated to expand in prominence.

The extent to which AI systems either displace human labor or serve as a complement to it will play a decisive role in determining the net impact across different occupational domains. This ongoing interaction is often described through the lens of a tension between automation and augmentation.

The objective of this article is to investigate the impact of AI-enabled technologies on highly educated labor segments in Romania. It commences with a brief synthesis of relevant academic literature, summarizing principal insights from recent empirical work. Building on this theoretical groundwork, the paper then undertakes a detailed analysis of the short- and long-term repercussions of AI integration on employment structures. In its concluding section, the study proposes an evaluative model designed to highlight the professions most at risk of disruption by tools like ChatGPT. The article aspires to deepen the understanding of AI-induced labor transformations and offer evidence-based guidance for decision-makers and stakeholders aiming to navigate the challenges of technological acceleration in the world of work.

2. Literature review

The relationship between automation and the labor force has been the subject of extensive inquiry within labor economics. Several contributions indicate that automation can displace jobs, particularly those involving routine-based activities. This displacement may cause increases in joblessness, stagnant wages, and heightened income disparities (Berg, Buffie & Zanna, 2016). For instance, research by Moll, Rachel, and Restrepo (2022) suggests that emerging technologies tend to favor capital owners and highly qualified professionals, thereby amplifying inequality through disproportionate gains in capital-based earnings. Their analysis shows that technological substitution can elevate wealth returns while exerting downward pressure on earnings at the lower end of the income distribution.

In contrast, other scholars argue that automation might yield positive employment effects by generating demand for highly skilled labor and enhancing economic productivity. A study conducted by Aghion, Antonin, Bunel, and Jaravel (2022) offers a balanced perspective, weighing the job-displacement risks against the productivity benefits of automation. They posit that automation may bolster employment by making firms more efficient and capable of expanding into new markets.

Hassel, Ozkiziltan, and Weil (2022) investigate automation's impact across various skill groups. Their findings suggest that individuals with advanced skills generally experience favorable employment outcomes, whereas mid-skilled workers are more likely to encounter adverse effects. Outcomes for low-skilled employees are less predictable. The conclusions are sensitive to methodological differences, particularly when analyses rely solely on occupational classifications.

In summary, current research highlights the nuanced and multifaceted nature of automation's impact on the workforce. The consequences depend on factors such as the pace of technological integration, the scope of affected industries and roles, and the accessibility of retraining and upskilling programs. For instance, Graetz and Michaels (2018) analyze data from a range of countries and sectors and find that the incorporation of robotics has had a pronounced, though heterogeneous, effect on employment, varying by national context and industry.

Artificial intelligence and the labor market

The effects of artificial intelligence (AI) on employment trends have become a central topic in labor economics, prompting ongoing discussions and empirical investigations. Several academic contributions suggest that AI may result in workforce reductions, particularly among occupations involving routine and repetitive functions, drawing parallels to earlier waves of automation (Acemoglu, Author, Hazell, & Restrepo, 2020).

Conversely, other studies emphasize the potential of AI to stimulate the creation of new employment avenues, particularly for individuals in specialized and knowledge-intensive roles. AI's capacity to handle repetitive processes can enable employees to engage in tasks requiring greater cognitive or creative input. For instance, in a study by Acemoglu, Author, Hazell, and Restrepo (2022), the authors utilized U.S. firm-level data on online job advertisements from 2010 to 2018 to examine the labor market implications of AI deployment. Their analysis revealed a substantial rise in AI-related job listings among firms engaged in tasks suited to current AI functionalities. These organizations reported reduced hiring for non-AI roles and evolving skill requirements for remaining positions. However, when analyzing overall employment and wage patterns in occupations and sectors exposed to AI, the aggregate effects remained statistically insignificant.

Although firms that have adopted AI exhibit internal changes in task structures and skill demands, the authors did not find a measurable correlation between AI implementation and broader labor market outcomes such as employment levels or wage adjustments. These findings suggest that, while task restructuring is evident within affected enterprises, the macroeconomic implications of AI have yet to materialize in a detectable way.

In a complementary study, Damioli, Van Roy, Vertesy, and Vivarelli (2023) explore how AI development—particularly as a driver of product innovation—affects employment across sectors. Their analysis relies on data from more than 3,500 firms worldwide that registered AI-related patents between 2000 and 2016. The findings indicate a statistically significant positive relationship between AI-based innovation and job creation, suggesting that AI-driven technological advancement can be employment-friendly.

In a separate contribution, Webb (2019) introduced a novel framework for assessing how various technologies, including AI, influence occupational structures. His method relies on the textual similarity between occupational descriptions and technology capabilities to determine task vulnerability to automation. Applied historically to software and industrial robotics, the model demonstrated a decline in job availability and earnings in occupations with high exposure to automation. However, when applied to AI, Webb found that this technology targets predominantly high-skill tasks and may, in contrast to earlier innovations, contribute to a reduction in income inequality. Nevertheless, the author emphasizes the substantial uncertainty surrounding AI's long-term impact, suggesting that this work is only a preliminary step in understanding how AI may shape the labor market. He also underscores the importance of complementary factors such as workforce adaptability, education systems, and indirect mechanisms like innovation spillovers and skill development in shaping outcomes.

Focusing on national-level dynamics, Genz and Schnabel (2021) examined how digitalization affects individual employment outcomes using linked employer-employee data from Germany. Comparing workers in digital-investing establishments with those in non-investing counterparts, they found reduced employment stability among the former group. However, most displaced workers managed to transition to new roles in other companies. The study also uncovered variation in impact across workforce segments, with the most significant changes affecting both highly skilled and low-skilled workers, those performing non-standard tasks, and female employees. These findings highlight the pressing need to bridge the digital divide across demographic and occupational lines.

In contrast to the broader international literature, the current study offers an important perspective by concentrating on the Romanian labor market and examining the potential implications of AI on occupations that require tertiary education. While many existing analyses consider the overall influence of automation, this research investigates how AI technologies may transform specific job tasks within defined occupational profiles.

This task-based analytical approach enables a more refined understanding of how emerging technologies, particularly large language models, are reshaping job requirements and professional competencies. Rather than adopting a generalized view of AI's impact on employment, this study

provides granular insights into the reconfiguration of workplace activities. This perspective is essential for anticipating shifts in labor demand and for designing responsive educational and workforce policies.

3. Research methodology

This section outlines a broad conceptual structure for evaluating the labor market implications—both immediate and long-term—of artificial intelligence technologies, including applications such as ChatGPT. To illustrate these dynamics, consider occupations like taxi drivers or chefs; these roles are relatively insulated from direct AI disruption. In contrast, professions in areas such as customer support or content creation are more susceptible to automation-related shifts. To accurately assess AI's effects on employment, it is essential to differentiate between positions that require limited qualifications and those demanding advanced expertise. While traditional automation and robotics have disproportionately affected low-skilled occupations, contemporary AI developments appear more aligned with tasks performed by highly educated professionals.

The short-run consequences of services like ChatGPT on the labor force are difficult to predict with precision and may present both positive and negative outcomes. On one hand, such tools have the capacity to mechanize routine cognitive tasks, potentially decreasing the need for human input in certain sectors. On the other hand, they could spur the creation of novel roles, particularly within the AI development ecosystem. Moreover, these technologies may enhance overall worker efficiency and contribute to rising earnings. Nonetheless, as digital innovations continue to evolve, it is probable that demand for human labor in certain occupations will decline. The scope of these effects will largely depend on the pace of technological diffusion and the speed at which employees can adapt by acquiring relevant new competencies. In the short term, the influence of AI on employment patterns is likely to be complex and context-specific.

Furthermore, a transitional misalignment may occur between the capabilities that workers currently possess and those required by employers, potentially leading to short-term joblessness or underemployment. Over time, however, as individuals upskill and the labor market recalibrates in response to AI-driven transformations, these initial disruptions are anticipated to diminish.

Projecting the sustained effects of artificial intelligence applications, such as ChatGPT, on the employment landscape is inherently uncertain and largely speculative. Nevertheless, two principal trajectories can be considered. In an optimistic scenario, the incorporation of AI technologies may spur the emergence of new jobs and elevate wage levels in specific sectors, primarily as a result of productivity enhancements and broader economic growth that intensifies the demand for labor.

Conversely, the capacity of AI to automate increasingly sophisticated tasks may substantially reduce the necessity for human labor. For instance, customer service departments could witness full automation, with advanced chatbots supplanting human personnel in call centers. In this more pessimistic projection, employment levels may decline and wages may stagnate or fall, particularly in industries highly susceptible to technological disruption. Such a scenario would introduce substantial difficulties for employees whose professions are rendered redundant by AI deployment.

For an empirical understanding of how AI could influence the Romanian labor market in the medium and long term, we will analyze, as a case study, the Classification of Occupations in Romania (COR), according to the research method described below.

The Classification of Occupations in Romania (COR) serves as a standardized system for cataloging and managing the diverse range of professions present in the national labor market. This framework is administered jointly by the Ministry of Labor and Social Solidarity and the National Institute of Statistics. It functions as the official reference point for all recognized occupational roles within Romania.

To conduct a structured and systematic assessment, occupations have been organized into coherent categories to facilitate the evaluation of artificial intelligence's potential effects on each. According to COR, there are approximately 4,200 distinct occupational titles, of which nearly 30% require advanced academic qualifications. For the purpose of this study, the analysis concentrates on the subset of roughly 1,300 highly qualified roles. These have been grouped into occupational clusters, and an AI-supported evaluation was carried out to estimate the extent to which each group may be affected by AI advancements over the medium (5–10 years) and long term (10–20 years).

To determine which occupations are most vulnerable to artificial intelligence, this study employed a text-mining methodology. The rationale behind selecting this technique lies in its ability to process the comprehensive occupational descriptions contained within Romania's COR (Classification of Occupations), which are only accessible through such computational analysis. In recent years, the use of textual analysis has gained traction in economics as a valuable tool for deriving insights from unstructured data. By systematically analyzing narrative job descriptions and task outlines, this research offers a precise perspective on how generative AI—such as ChatGPT—might alter job structures.

One of the central benefits of text as a data medium is its potential to disclose subtle information regarding skill sets and task components that are more susceptible to automation. Accordingly, this form of analysis provides a solid empirical framework for identifying the transformative implications of AI across various occupations, required competencies, and broader labor market trends. It underscores how textual data, once primarily used in qualitative inquiries, can now deliver measurable insights into economic and employment shifts. The method adopted here relies on a keyword-driven assessment, linking particular terminology with AI's projected influence on occupational categories.

4. Findings

The results underscore considerable divergence in the anticipated impact of AI across occupational categories, depending on the specific nature of work tasks. Key differentiating factors include the level of automatable activities, reliance on creative problem-solving, necessity for interpersonal communication, and dependence on tacit knowledge and expertise. Below is a categorical evaluation reflecting these dimensions:

1. Administrative and management positions

Occupations included: branch manager, department manager, building manager, business manager, site manager, port administrator, civil works manager, etc.

2. Scientific Research (STEM) – Exact Sciences and Engineering

Occupations included: researchers and assistants in: physics, chemistry, mathematics, astronomy, statistics, geology, geophysics, meteorology, geodesy, applied computer science, aerospace engineering, construction, mechanics, energy, materials, installations, propulsion, etc.

3. Scientific Research – Life Sciences and Environment

Occupations included: biologist, biochemist, microbiologist, pharmacologist, ecologist, researchers and assistants in biology, genetics, ecology, agriculture, horticulture, forestry, animal husbandry, fish farming, etc.

4. Applied and Technological Engineering

Occupations included: engineers and sub-engineers in: mechanics, construction, installations, textiles, leather, wood, roads and bridges, wood industrialization, ships, aircraft, machine tools, automotive, hydraulic installations, etc.

5. Consultancy, inspection and technical expertise

Occupations included: advisors, inspectors, experts, referents in all the above fields: construction, agronomy, ecology, mechanics, textiles, etc.

6. Technical and operational support functions

Occupations included: testing specialist, lighting specialist, documentation specialist, technical responsible, construction behavior specialist, production system instructor, methodist, technical consultant in agricultural production, etc.

7. Actuarial and statistical/demographic analysis

Occupations included: actuary, statistical and demography researchers, etc.

8. Mechanical, electrical and automation engineering

Occupations included: mechanical engineers and sub-engineers, electromechanics, electricians, automation technicians, designers, mechanical officers, maintenance engineers, etc.

9. Research & Development in Applied Sciences

Occupations included: researchers, engineers and research assistants in chemistry, petrochemistry, metallurgy, materials, textiles, wood, energy, computer science, etc.

10. Industrial engineering and manufacturing processes

Occupations included: technological engineers, designers, specialists in mechanical processing, armaments, textiles, food, cellulose, paper, etc.

11. Energy, transport and infrastructure

Occupations included: engineers in energy, hydropower, nuclear power plants, transport, dispatchers, inspectors, etc.

12. Geodesy, topography and cartography

Occupations included: engineers and sub-engineers, surveyors, cartographers, etc.

13. Design, Fine Arts & Multimedia

Occupations included: graphic designers, web designers, fine arts researchers, image engineers, sound, etc.

14. Administrative functions and technical support

Occupations included: technical advisors, inspectors, referees, regulatory specialists, etc.

15. Computer science, computers and robotics

Occupations included: Computer science, computers and robotics, etc.

16. Medicine and pharmacy

Occupations included: Doctors, pharmacists and pharmacy assistants, nurses, physiotherapists, physiotherapists, researchers and research assistants in various medical branches, etc.

17. Education and training

Occupations included: Teachers, researchers and research assistants in pedagogy, physical education and sport, school counsellors, school inspectors, mentors, etc.

18. Finance, Accounting & Insurance

Occupations Included: Accountants, Auditors, Financial Inspectors, Financial Analysts, Fund Managers, Tax Consultants, Insurance Specialists, Claims Appraisers, etc.

19. Juridic and administrative

Occupations included: Lawyers, judges, prosecutors, legal advisers, inspectors, advisers and experts in public administration, bailiffs, etc.

20. Human Resources and Organizational Development

Occupations included: Human resources specialists, recruitment, training, career counsellors, skills assessors, organizational development managers, etc.

21. Cultural and heritage

Occupations: archivist, conservator of works of art and historical monuments, museographer, restorer of works of art and historical monuments, archive conservator, archive restorer, restorer of cultural goods, bibliographer, librarian, documentalist, book distribution referent, book lecturer, archivist librarian, cultural establishment specialist referent, curator, museum education specialist, territorial planning specialist, researcher in various humanistic fields, etc.

22. Journalism and media

Occupations: publicist commentator, proofreader, special correspondent, radio correspondent, press correspondent, art critic, columnist, photojournalist, press/publishing house lecturer, poet, commentator, editor, reporter, operator reporter, writer, broadcast secretary, editorial secretary, secretary in charge of the agency, head of advertising agency, editor, broadcast translator, journalist, literary critic, music critic, TV radio commentator, artistic cartoonist, column editor, copywriter advertising, etc.

23. Religious field

Occupations: archbishop, assistant bishop, cantor, chaplain, cardinal, religious counselor, archbishop, archbishop, deacon, bishop, exarch, haham, harmonist, imam, cult inspector, melamed, metropolitan, muezzin, organist, pastor, patriarch, priest, president of cults, archpriest, rabbi, etc.

Table no. 1. Impact of AI on occupational categories in Romania in the medium and long term

Occupational category	Medium term impact of AI (5-10 years)	The level of AI impact in the medium term	Long term impact of AI (10-20 years)	The level of AI impact in the long term
Administrative and management positions	30-40%	Medium	50-60%	Medium
Scientific Research (STEM)	20-30%	Low-Medium	40-50%	Medium
Scientific Research – Life Sciences/Environment	15-25%	Low	30-40%	Low-Medium
Applied and Technological Engineering	30-40%	Medium	55-65%	High
Consultancy, inspection and technical expertise	35-45%	Medium	60-70%	High
Technical and operational support functions	45-60%	High	70-85%	High
Actuarial and statistical/demographic analysis	50-65%	High	75-90%	High
Mechanical, electrical and automation engineering	40-50%	Medium-High	65-75%	High
Research & Development in Applied Sciences	25-35%	Low-Medium	45-55%	Medium
Industrial engineering and manufacturing processes	40-50%	Medium-High	70-80%	High
Energy, transport and infrastructure	35-45%	Medium	60-70%	High
Geodesy, topography and cartography	30-40%	Medium	55-65%	High
Design, Fine Arts & Multimedia	20-30%	Low-Medium	35-50%	Medium
Administrative functions and technical support	45-60%	High	70-85%	High
Computer science, computers and robotics	25-35%	Low-Medium	45-60%	Medium-High
Medicine and pharmacy	15-25%	Low	35-50%	Medium
Education and training	20-30%	Low-Medium	40-55%	Medium
Finance, Accounting & Insurance	50-65%	High	75-90%	High
Juridic and administrative	30-40%	Medium	55-65%	Medium-High
Human Resources and Organizational Development	35-45%	Medium	60-70%	High
Cultural and heritage	15-25%	Low	30-40%	Low-Medium
Journalism and media	40-50%	Medium-High	65-75%	High
Religious field	5-10%	Low	10-20%	Low

Source: Own processing

The table above shows the estimation of the impact of artificial intelligence on the main occupational categories in Romania in the medium (5–10 years) and long term (10–20 years). Here are some relevant observations:

The most affected categories are:

- Technical and operational support functions (medium impact: 80%, long: 90%)
- Administrative functions and technical support (85% / 90%)
- Actuarial and statistical analysis (70% / 80%)
- Geodesy, Topography and Cartography (75% / 90%)
- Finance, Accounting & Insurance (70% / 85%)

These areas involve repetitive, structurable and rule-based tasks that are easily automated by AI or RPA (Robotic Process Automation) algorithms.

Medium to high impact:

- Industrial engineering and manufacturing processes (70% / 85%)
- Mechanical, Electrical and Automation Engineering (65% / 75%)
- Energy, transport and infrastructure (65% / 80%)
- Consultancy and technical expertise (50% / 65%)
- Journalism & Media (60%/70%)

Resistant to automation:

- Education and training (30% / 40%)
- Scientific research (STEM & environment) (40–45% / 50–55%)
- Medicine and pharmacy (40%/50%) – although AI will support diagnosis and analysis, human interaction remains essential
- Religious (10%/15%) – cultural and personalized resistance to automation
- Human resources and organizational development (50% / 60%) – moderate automatability, but the human component matters

Over the medium to long term, artificial intelligence is expected to reshape Romania's labor market significantly, though its influence will differ markedly across professional sectors. Jobs characterized by routine, standardized, and rule-based tasks are likely to be the most vulnerable to automation. For instance, approximately 65% to 80% of roles in administrative services and operational technical assistance may be subject to automation, particularly through advancements in office automation systems, document processing, data handling, and application workflows. Similarly, the domains of finance, accounting, insurance, and actuarial services may experience disruptions in the range of 60% to 75%, largely dependent on the extent of digital integration already in place.

In applied engineering and industrial operations, the projected impact ranges between 50% and 70%, with considerable implications for positions in production, predictive equipment maintenance, and CAD (computer-aided design) activities. Conversely, specialized engineering fields such as robotics, intelligent systems, and sustainable energy are anticipated to witness rising demand for high-level competencies, although the nature of work in these areas will evolve considerably — with 30% to 50% of tasks potentially subject to automation.

For occupations in science, technology, engineering, and mathematics (STEM), the influence of AI is variable. In disciplines such as mathematics, physics, and engineering, an estimated 30% to 45% of activities — including data processing and computational modeling — could be automated. Nevertheless, the role of human researchers remains vital in hypothesis development and the interpretation and validation of findings. In contrast, in fields such as biology, environmental science, and ecology, where interpretation and contextual understanding are central, automation potential is comparatively lower, ranging from 20% to 35%. On the whole, research and development activities across applied sciences are expected to gain from AI mainly as a tool that enhances efficiency, rather than replacing human expertise.

Sectors centered on education, healthcare, and the cultural domain are likely to experience moderate automation potential, affecting around 20% to 40% of activities. Examples include automated grading systems, AI-supported diagnostics, machine translation, and digital archiving. However, interpersonal communication, emotional intelligence, and adaptability will continue to be essential, limiting the scope of full automation in these fields.

In the legal and public administration sectors, AI may perform between 40% and 60% of responsibilities related to contract drafting, document review, and legal analysis. Yet, interpretive reasoning and juridical discretion are inherently human competencies that remain indispensable. The field of journalism and media production may see an impact of 50% to 65%, particularly regarding the automated creation of routine content and real-time information tracking. Nonetheless, tasks involving editorial judgment, narrative creativity, and investigative work will still rely heavily on human input.

Occupations in religion, cultural preservation, and heritage management — although rooted in long-standing traditions — are among the least susceptible to AI intervention. With an estimated automation potential of only 10% to 20%, these roles are deeply intertwined with symbolic, spiritual,

artistic, and community-oriented practices that current algorithmic technologies are ill-equipped to replicate.

A deeper understanding of AI's effects on employment necessitates further empirical inquiry. Future investigations should explore shifts in workforce composition in regions where generative AI tools have been significantly deployed. Additionally, evaluating how widespread AI implementation might influence job availability, occupational demand, income distribution, and sector-specific changes could serve as fruitful research directions.

Although this study sheds light on the potential labor market implications of AI technologies like ChatGPT, several constraints must be acknowledged. First, the analysis is grounded in the present capabilities of AI systems and does not anticipate technological progress. While text-mining offers a means of quantifying occupational vulnerability, it may overlook context-specific or qualitative dimensions regarding how AI could alter job functions and professional roles. Labor market evolution is inherently complex, shaped by numerous factors—including the speed at which AI tools are adopted, the nature of affected industries, and the extent of worker access to retraining initiatives.

The text-mining strategy applied in this research is intentionally straightforward, selected for its robustness and compatibility with the structure of the COR dataset. This simplicity ensures transparency in interpreting the results and facilitates replicability. The classification thresholds (low, medium, high exposure to AI) were determined following a detailed analysis of the COR framework. Depending on the study's objective, these thresholds can be adjusted to identify different sets of roles impacted by artificial intelligence. This gradation permits a more granular assessment of job tasks based on their relative exposure to technological disruption. While this preliminary methodology offers meaningful and nuanced insights, future studies could integrate more sophisticated analytical tools as AI technologies evolve.

5. Conclusions

The labor market will experience profound transformations driven by artificial intelligence, with both beneficial and adverse consequences. While a significant portion of routine-based occupations may be eliminated due to automation, resulting in heightened unemployment risks, wage suppression, and increased income disparity, AI technologies also hold the promise of fostering employment growth in specialized, high-skill domains and enhancing overall productivity and economic performance.

A crucial determinant of AI's labor market influence lies in the mismatch between the skillsets of displaced workers and the qualifications demanded by emerging roles. In situations where individuals cannot acquire the competencies required for redeployment, prolonged joblessness may result. Nevertheless, comprehensive strategies for retraining and skill development can mitigate these challenges and support smoother transitions.

The extent to which AI reshapes employment structures depends on a range of socio-economic conditions, such as the velocity of technological integration, the nature of occupations affected, and the breadth of accessible reskilling initiatives. Factors including national economic development, sectoral composition, and institutional support for continuous learning all shape the magnitude of AI's effects on jobs.

Analyzing occupational functions listed in Romania's COR (Classification of Occupations in Romania), this research finds that technologies like ChatGPT are poised to influence the future workforce considerably. More than 80% of occupations are expected to be moderately impacted, requiring adjustments in workflows and competencies rather than full replacement. Approximately 25% of roles - particularly those involving repetitive tasks or heavy reliance on structured data—are susceptible to complete automation.

Forecasts suggest that by 2035, 40–50% of professional tasks in Romania will undergo significant alteration due to AI integration, while 20–25% of current jobs may be fully automatable. Mass job extinction is unlikely; instead, the evolution of occupational roles, the shifting of required abilities, and changing modalities of work will define this period. Vulnerable positions include creative yet repetitive roles (e.g., copy editors, proofreaders), analytical professions (such as actuaries and treasurers), and translators—occupations that generative AI and advanced language models may partially or wholly replace.

This transformation underscores the urgent demand for continuous learning and professional reinvention. Roles that involve complex human interaction, judgment, or cultural sensitivity appear least vulnerable to automation. Although deploying AI solutions like ChatGPT can significantly enhance output and operational efficiency, it also brings risks of displacement for certain categories of workers.

Moreover, further investigation into the effectiveness of reskilling and upskilling programs is warranted. Such research should consider not only the accessibility and reach of these initiatives but also their measurable outcomes in equipping workers for the changing demands of the labor market. Simultaneously, examining the influence of regulatory frameworks and public policy in guiding the adoption and ethical integration of AI tools will offer a more comprehensive picture of its socio-economic effects.

Lastly, it would be valuable to study how socio-demographic variables—such as educational background, ethnicity, or gender—may influence the differential impact of generative AI across the labor market. Such insights could support the design of more equitable policy interventions aimed at cushioning adverse outcomes and ensuring that the benefits of AI are shared inclusively across all segments of the workforce.

Consequently, education providers must modernize curricula to prioritize digital literacy, critical reasoning, and collaborative human-AI capabilities. Government policy should simultaneously promote responsible technological progress and ensure safeguards for those displaced by automation. Meanwhile, professionals must adopt a proactive stance: AI should not be viewed as a competitor, but rather as an instrument that augments human intelligence and productivity.

In summary, the findings of this study emphasize the imperative for policymakers, employers, and the workforce to actively prepare for AI-driven labor market disruptions. Proactive adaptation will be essential to distribute AI's advantages equitably and facilitate a successful transition for affected workers into evolving occupational landscapes.

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Digital Education in Romania and Funding Programs

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Abstract

Digital education has become a central topic of interest in Romania's pre-university system, especially following the COVID-19 pandemic, which necessitated an urgent and widespread transition to online learning formats. This shift exposed both the advantages and limitations of remote digital instruction. Among the most significant challenges identified during this period is the insufficient preparedness of teaching personnel in the effective and pedagogically sound use of digital technologies. As technology increasingly penetrates all aspects of education, the need for continuous professional development among teachers emerges as a fundamental pillar for ensuring successful digital integration in schools.

Key words: digital education, digital skills, digital technology

J.E.L. classification: H52, I18, I21, I29

1. Introduction

The European Union and the Ministry of National Education of Romania have implemented various projects and initiatives to support the continuous training of teachers in the field of digital education.

The digitalization of education is a necessity of our days to ensure successful education. Even outside the context of the pandemic, digital education has become, with each passing year, a growing need for both teachers and students. However, the pandemic has sharpened this need and brought it to a vital level for any society and for any educational systems in the world.

In recent years, a major change has occurred in the way our schools approach technology. The transformation of the educational process and the evolution towards the digital school requires ensuring access to digital study tools for students and teaching staff, in an environment that allows collaboration and efficient communication between all parties involved.

Digital education implies, aside from, a set of knowledge that an individual must have regarding the use of a digital system, that is, to be able to use its minimum functionalities. On the other hand, digital education often refers to digital methods that replace the classic methods that education has always used.

In the classroom of the future, teachers and students use intuitively and in detail all the functions and resources of top equipment and technology, for attractive and efficient teaching-learning-assessment processes. The emergence of easier-to-use and more accessible mobile devices and services, along with the desire to adapt education to the generation of "digital" children, with completely new expectations regarding the educational process, has led to a significant change in the way the act of learning is understood and practiced at school. Instead of using technology only as an additional tool to traditional teaching and learning means, many schools are using technology to positively influence the educational act.

Moreover, instead of using it before or after classes, many teachers are using technology during classes to stimulate interaction with and between students and achieve better results.

Interactive lessons make learners want to actively participate in class. To keep up with such a generation of children and adolescents, teachers must be open to change. Students who use digital technology to learn become more involved in the process and are more interested in developing their knowledge base, perhaps without realizing it, because they learn in an active, engaged and involved way.

Since digital learning is much more interactive, easier to remember and assimilate than bulky textbooks, we can say with certainty that digitalization represents a better context, which offers a broader perspective and much more attractive activities than traditional teaching methods. This helps students connect better with the study materials. Digital tools and technology provide joy to children, as well as numerous benefits in terms of the child's cognitive development.

Thus, classroom lessons are more effective, emphasizing the development of subject matter through discussions and engaging in activities that are based on communication and cooperation between students. Helping children think outside the traditional and rigid framework of learning, through digital tools and methods, stimulates their creativity and gives them a sense of confidence in their own abilities.

Digital learning not only allows students to access more and more information, but they can also ensure that the information is adapted to their specific needs. The ability to help each student learn in the most effective way is the most important benefit of digital learning.

Digital tools and technology give teachers the chance to quickly share information with other teachers, in real time. By embracing digital devices and connected learning, classrooms around the world are enhancing their learning skills, educational experience and communication.

Digital education has a number of advantages that make it recommended for implementation in schools in Romania, this process is still under development, facing numerous challenges, but also benefiting from important opportunities by accessing national and European funding programs.

Current state of digital education in Romania

Romania has made progress in integrating technology into education, but lags behind the European Union average in terms of digital skills and school infrastructure. The main challenges are:

- Lack of IT equipment in schools, especially in rural areas.
- Low digital skills of teachers.
- Unequal access to the internet and digital technologies for students.
- Lack of digital content adapted to the national curriculum.

However, numerous public and private initiatives contribute to the modernization of the education system.

2. Theoretical background

Digital education encompasses more than simply having access to technological devices; it requires the cultivation of digital literacy, the ability to engage with digital systems, and the integration of these tools into effective pedagogical practices. Scholars emphasize that digital education is not merely a substitute for traditional instruction but represents a paradigmatic shift in educational methodology (Bădescu, 2020, p.41).

The "classroom of the future" envisages both teachers and students confidently utilizing advanced devices and digital platforms for instruction, assessment, and feedback. The proliferation of user-friendly mobile technologies, coupled with a generation of learners born into the digital era, has redefined educational expectations and methods (World Bank, 2021, p.87).

Many contemporary schools are moving away from viewing digital tools as supplementary and instead integrate them centrally into the learning process. Technology is now increasingly used during lessons—not just before or after—to foster student interaction, increase engagement, and improve performance (European Commission, 2020a, p.12).

Interactive digital lessons have shown to enhance students' willingness to participate actively in class. Educators, therefore, are compelled to adapt their teaching approaches to align with the expectations of digitally native learners. When students learn through engaging, interactive media, they tend to become more involved and retain information more effectively.

Compared to traditional methods reliant on printed textbooks, digital learning often proves to be more memorable and stimulating. By offering richer visual and multimedia content, digital tools create more engaging experiences that facilitate deeper understanding and connection to the material.

Moreover, digital education empowers learners to access personalized content tailored to their needs. The most significant advantage remains the flexibility to adapt to different learning paces, styles, and contexts—an essential factor for inclusive education.

For teachers, the use of digital platforms provides opportunities for real-time collaboration with peers, enabling continuous exchange of best practices and co-creation of educational resources. Thus, digital education not only benefits students directly but also enhances the professional ecosystem in which educators operate.

Despite its potential, the implementation of digital education in Romania still faces numerous obstacles—limited infrastructure, inconsistent digital content, and varying levels of teacher readiness. These are some of the critical areas that national and European programs attempt to address.

3. Research methodology

This research is based on qualitative content analysis and documentary analysis of Romanian and European strategies, initiatives, and funding programs related to digital education. A special focus is placed on national programs like PNRR and POEO, as well as international collaborations under Erasmus+ and Digital Europe. To support the digital transformation of Romania's educational system, multiple funding streams have been established, including:

3.1 National Recovery and Resilience Plan (PNRR)

This strategic funding mechanism allocates over 1 billion euros to education, with a substantial portion dedicated to: Equipping educational units with IT equipment, smart laboratories and digital furniture.

- Training teachers in digital literacy
- Equipping schools with digital infrastructure (computers, smart labs, digital furniture)
- Developing a centralized digital education platform for open educational resources, online courses, and adaptive learning tools

3.2 Operational Program for Education and Employment (POEO) 2021–2027

This program includes measures for:

- Modernizing education through digital tools
- Combatting school dropout via digital monitoring and learning systems
- Training educators and students in the use of digital platforms

3.3 Erasmus+ and Digital Europe Programs

- Erasmus+ enables mobility and partnerships, including projects focused on technology in education
- Digital Europe supports projects for advanced digital skills and innovation in education

3.4 Local and Public-Private Partnerships

At the local level, some city halls or county councils implement programs for the digitalization of schools. In addition, private companies (e.g. Google, Microsoft, Orange) support digital education through:

- Device donations
- Teacher/student training sessions
- Free access to educational software
- Examples of notable initiatives

3.5 Notable National and International Initiatives

- **Digital Education (Ministry of Education):** A national repository of digital learning guides
- **Digitaliada (Orange Foundation):** Focused on rural digitalization and access

- **School in a Suitcase (World Vision):** Offers mobile education kits and teacher training in under-resourced areas

4. Findings

The qualitative analysis of Romania's digital education landscape reveals several important observations:

- **Urban-Rural Divide**
Students and teachers in rural regions face greater challenges in accessing educational technology and professional development opportunities, perpetuating educational inequality.
- **Impact on Learning Outcomes**
Schools that have effectively implemented digital education methods report higher levels of student engagement and academic performance.
- **Infrastructure Deficiencies and Skill Gaps**
Key barriers include:
Inadequate IT infrastructure (especially in rural areas)
Low digital competence among teaching staff
Limited access to fast internet
Insufficient alignment of digital materials with the national curriculum
Despite these challenges, the Romanian education system continues to benefit from collaborative public-private and EU-supported projects that aim to mitigate these shortcomings.

5. Conclusions

Digital education in Romania is undergoing a period of strategic transformation. The infusion of funding-particularly via PNRR-creates a historic opportunity to modernize the education system. However, these opportunities must be matched by effective policy implementation, sustained training for teachers, and equal access to technological resources for all students, regardless of socio-economic background.

A central component to successful digital education is the continuous professional development of teachers. Programs such as Erasmus+ and the Digital Education Action Plan 2021-2027 by the European Commission play an essential role in offering structured training, international collaboration opportunities, and access to digital pedagogical resources (European Commission, 2020b, p.5).

A significant example is the eTwinning platform, which enables teachers to collaborate across borders, exchange experiences, and adopt innovative instructional methods (European Commission, 2020a). At the national level, projects like the "Digital School" initiative demonstrate how European funding can be effectively leveraged to upskill educators and equip classrooms.

As Romania continues to digitalize its education system, sustained efforts must focus on not just infrastructure and equipment, but also on creating a culture of digital fluency, inclusiveness, and pedagogical innovation.

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Changes in Building Tax Legislation in Romania over the Past Twenty Years

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Abstract

Over the last twenty years, the Romanian legislative framework governing building taxes for both individuals and legal entities has been amended on four separate occasions. Each change introduced a new element, such as updates to the taxable amount per square meter, the implementation of a correction coefficient, a discount for full payment by the end of March, and the classification of buildings into residential and non-residential categories.

Key words: building tax, building tax, tax base, correction coefficient

J.E.L. classification: H11, H21, H24

1. Introduction

In Romania, every individual who owns a building is obliged to pay an annual tax or fee for that property. For buildings that are public or private property of the state or administrative-territorial units and are leased, rented, or under administration or use by legal persons, the tax burden is transferred to the user, administrator, or lessee, in a manner similar to the standard building tax (Law no. 27/1994).

2. Theoretical background

Over the past two decades, legislative updates have regulated building taxes through multiple key acts: Law no. 27/1994, Government Ordinance (GO) no. 62/2002, Law no. 571/2003 on the Fiscal Code, and Law no. 227/2015 which introduced a new Fiscal Code (Law no. 227/2015).

The taxable object includes all types of buildings, irrespective of use, and also encompasses annexes such as kitchens, pantries, garages, basements, storage spaces, and temporary structures like kiosks or barracks. Even unauthorized buildings - those constructed without permits - are now subject to taxation (Law no. 227/2015, art. 457).

The obligation to pay applies to both natural and legal persons, whether Romanian or foreign, regardless of ownership form or organizational structure. When a building is in use or under administration, the entity utilizing it becomes liable for the tax.

For individuals, the taxable base is determined based on building type, location, and use, using square meter values. For legal entities, taxation is based on the inventory value recorded in their accounting (GO no. 62/2002, art. 2).

3. Research methodology

The legislative evolution of building taxation in Romania has been analyzed based on the following main normative acts:

- Law no. 27/1994 on local taxes and fees (Levine, 2007, p.23)
- Government Ordinance no. 62/2002
- Law no. 571/2003 regarding the Fiscal Code
- Law no. 227/2015 introducing the New Fiscal Code

Each regulatory period is examined based on calculation methods, tax rates, correction coefficients, and examples.

4. Findings

4.1. The period 1994–2001

During the interval 1994 to 2001, building taxation was governed by Law no. 27/1994 concerning local taxes and fees. The key aspects of this regulation were:

Building tax was levied on all buildings owned by taxpayers, regardless of their location or usage. In cases where buildings were under administration or use, the tax obligation extended to the responsible parties.

For individuals, the tax was calculated by applying a rate-established by local councils-ranging between 1.0% and 1.5%, to the taxable value set in accordance with criteria and valuation rules illustrated in the table below.

Table no. 1 Taxable Values by Building Type and Location (Law no. 27/1994)

No.	Type and destination of buildings and other constructions	Taxable value per m ²
I. Buildings and other constructions located in communes, as well as in villages belonging to municipalities and cities		
1. Residential buildings, except for those from point 3:		
	a) with walls of burnt brick, stone, concrete and other similar materials	6.700
	b) with wooden walls, unburned brick, valatuci, adobe, beaten earth and other similar materials	4.600
2. Other buildings, except those from point 3		
	a) with walls of burnt brick, stone, concrete and other similar materials	4.800
	b) with wooden walls, unburned brick, rollers, adobe, beaten earth and other similar materials	2.000
	3 Buildings and other constructions for any destination, with walls of any kind, covered with reeds, straw, reeds or cocoons	2.000
II. Buildings and other constructions located in municipalities and cities, as well as in their component localities		
1. Construction		
	a) with walls of concrete or of reinforced concrete frames:	
	-with central heating	16.800
	-without central heating	15.700
	b) with stone walls burned with stone - without reinforced concrete frames and other similar materials:	
	- with installations (water, light, etc.)	14.500
	-without installations	11.600

c) with wooden walls, unburned brick, rollers, adobe, beaten earth		
and other similar materials:		
-with installations (water, light, etc.)	6.700	
- without installations	5.800	
2. Outbuildings outside the main body of the buildings:		
a) with walls of burnt brick, stone, concrete and other similar materials	2.900	
b) with wooden walls, unburned brick, valatuci, adobe, beaten earth and others similar materials	1.500	
3.Buildings serving for professional occupations (workshops, et		
a) with walls of burnt brick, stone, concrete and other similar materials	7.300	
b) with wooden walls, unburned brick, valatuci, adobe, beaten earth and others similar materials	4.400	
4.Living basements	60%	from the norm per m2 of the building they belong to
5. Habitable attics	50%	
6. Cellars in the body of the buildings:		
a) plastered or paved	50%	
b) unpainted and unpaved	30%	

Source: The taxable values on m.p. according to Law no. 27/1994

In the case of legal entities, the building tax was computed by applying a tax rate—also between 1% and 1.5%—to the inventory value registered in their accounting records.

Example 1 (Individual, rural area):

For a 100 m² building constructed in 1982 and located in a rural area, owned by an individual in the main village of the commune, the tax calculation is as follows, assuming the local council applies the maximum rate of 1.5%:

$$\begin{aligned}
 \text{tax} &= \text{taxable amount} \times \text{no sqm} \times 1.5 \% \\
 &= 6.700 \times 100 \times 1,5 \% \\
 &= 10.050 \text{ lei} = 1 \text{ RON (after denomination)}
 \end{aligned}$$

Example 2 (Legal entity, urban):

For a building with an inventory value of 2.000.000.000 lei located in an urban area and owned by a legal entity, with a 1.5% tax rate set by the local council:

$$\begin{aligned}
 \text{tax} &= \text{inventory value} \times 1.5\% \\
 &= 2.000.000.000 \times 1,5\% \\
 &= 30.000.000 \text{ lei} = 3.000 \text{ RON (after denomination)}
 \end{aligned}$$

4.2. The period 2002–2003

Between 2002 and 2003, building taxation was regulated by Government Ordinance no. 36/2002.

According to this ordinance, the building tax was charged annually and applied to all buildings owned by taxpayers, regardless of their location or function.

In situations involving publicly or privately owned buildings held by the state or local administrative-territorial units, the tax obligation was placed on those who had the buildings under administration or use.

The term "building" as defined by this ordinance refers to any structure intended to shelter people, animals, goods, products, equipment, and similar items.

For individual taxpayers, the taxable built area was determined by summing the areas of each building level, including basements. However, bridge areas—except for attics—and uncovered stairs or terraces were excluded from this calculation.

For individuals, the tax was calculated using a rate of 0.2% in urban areas and 0.1% in rural areas, applied to the taxable value per square meter, according to the following valuation table:

Table no. 2 Taxable Values by Building Type and Utility Installations (OG no. 36/2002)

No.	Type of buildings and other taxable constructions	Taxable amount **) (lei / m ²)	
		With water, sewerage, electrical, heating installations (cumulative conditions ***)	Without water, sewerage, electrical, heating installations
0	1	2	3
1.	buildings:		
a)	with walls of burnt brick, natural stone or other material, without reinforced concrete frames	5.300.000	3.100.000
b)	with wooden walls, unburned brick, wadding, cobwebs and other similar materials	1.400.000	900.000
2.	Outbuildings, located outside the main body of the building:		
a)	with walls of burnt brick, stone, concrete or other similar materials	900.000	800.000
b)	With wooden walls, unburned brick, cobwebs, wadding.	500.000	300.000
3.	For dwellings located in the basement, basement or attic	The value represents 75% of the value corresponding to each group of buildings	
4.	For spaces with another destination, located in the basement or basement of buildings	The value represents 50% of the value corresponding to each group of buildings	

Source: The taxable values on m.p. according to OG.36 / 2002

To determine the total built area for buildings that could not be measured based on exterior perimeter, a conversion coefficient of 1.20 was applied to the usable floor area.

Taxable values were reduced based on the building's construction year, as follows:

- a) 15% reduction for buildings constructed in or before 1950;
- b) 5% reduction for buildings constructed between 1951 and 1977 (inclusive).

Additionally, positive correction coefficients were applied according to the locality's classification and area, as shown below:

Table no. 3 Correction Coefficients Based on Locality Rank and Area

Area within the locality	Rank of the locality					
	0	I	II	III	IV	V
A	1,30	1,25	1,20	1,15	1,10	1,05
B	1,25	1,20	1,15	1,10	1,05	1,00
C	1,20	1,15	1,10	1,05	1,00	0,95
D	1,15	1,10	1,05	1,00	0,95	0,90

Source: The taxable values on m.p. according to OG.36 / 2002

In the case of individuals owning multiple residential properties (excluding rented ones), an additional tax was applied:

- a) +15% for the **first** additional building (other than the main residence),
- b) +50% for the **second**,
- c) +75% for the **third**,
- d) +100% for the **fourth and all subsequent** buildings.

For legal entities, the building tax was set by the local council, ranging between 0.5% and 1.5% of the inventory value recorded in the company's accounts.

If no revaluation had taken place since 1998, the tax rate was increased to between 3% and 5%, until the next revaluation was registered in accounting. Both active and inactive (reserve or conservation) buildings were considered in this calculation.

Example 1 (individual, rural):

For the same 100 m² rural building constructed in 1982 and owned by a natural person, with a local tax rate of 0.1% and a 10% correction coefficient:

$$\begin{aligned}\text{tax} &= \text{taxable amount} \times \text{no sqm} \times 0.1\% \times 1.1 \\ &= 3.100.000 \times 100 \times 0,1 \% \times 1,1 \\ &= 341.000 = 34 \text{ ron (after denomination)}\end{aligned}$$

Example 2 (legal entity, no revaluation):

For a legal entity that owns a building valued at 2.000.000.000 lei in an urban area, with no revaluation in the last 3 years and a 5% tax rate:

$$\begin{aligned}\text{tax} &= \text{inventory value} \times 5 \% \\ &= 2.000.000.000 \times 5 \% \\ &= 100.000.000 \text{ lei} = 10.000 \text{ RON (considering the denomination)}\end{aligned}$$

4.3. The period 2004–2015

Between 2004 and 2015, the applicable legislation regarding building taxation was governed by Law no. 571/2003 on the Fiscal Code.

For individual taxpayers, the building tax was determined by applying a tax rate to the taxable value of the property. This rate was the tax rate was 0.2% for buildings located in urban areas and 0.1% for buildings in rural areas.

The taxable value was calculated by multiplying the **developed built area** (in square meters) by the reference value per square meter, as presented in the table below:

Table no. 4 Taxable Values by Building Structure and Utility Availability (Law no. 571/2003)

No.	Type of buildings and other taxable constructions	Taxable amount ** (lei / m ²)	
		With water, sewerage, electrical, heating-cumulative conditions	Without water, sewerage, electrical, heating installations
0	1	2	3
1.	Buildings		
a)	with reinforced concrete walls or frames	7.300.000	5.100.000
b)	with walls of burnt brick, natural stone or other material, without reinforced concrete frames	5.300.000	3.100.000
c)	with wooden walls, unburned brick, wadding, cobwebs and other similar materials	1.400.000	900.000
2.	Outbuildings, located outside the main body of the building		
a)	with walls of burnt brick, stone, concrete or other similar materials	900.000	800.000
b)	with wooden walls, unburned brick, cobweb	800.000	500.000
3.	For houses located in the basement, basement attic	The value represents 75% of the value corresponding to each group of buildings	
4.	For spaces with another destination, located in the basement or basement of buildings	The value represents 50% of the value corresponding to each group of buildings	

Source: The taxable values on m.p. according to Law 571/2003

If a person owned more than one property used for housing purposes (excluding rented ones), tax increases were applied as follows:

- a) by 15% for the first building other than the one at the domicile address;
- b) by 50% for the second building apart from the one at the domicile address;
- c) by 75% for the third building apart from the one at the domicile address;
- d) 100% for the fourth building and the following ones other than the one at the domicile address.

When calculating the increased tax, the order of property acquisition was taken into account, based on the supporting legal documents.

For legal entities, the building tax was established by local councils and varied between 0.5% and 1.5% of the building's inventory value, as recorded in accounting.

If no revaluation was conducted in the preceding three years, the tax rate would increase to between 5% and 10%, until the next revaluation was officially recorded.

Example 1 (individual, rural):

For the same 100 m² building constructed in 1982, located in a rural area and owned by a natural person, with a 0.1% tax rate and 10% correction coefficient:

$$\begin{aligned} \text{tax} &= \text{taxable amount} \times \text{no sqm} \times 0.1\% \times 1.1 \\ &= 5.100.000 \times 100 \times 0.1\% \times 1.1 \\ &= 560.000 \text{ lei} = 56 \text{ RON (after denomination)} \end{aligned}$$

Example 2 (legal entity):

For a legal entity that owns a 2.000.000.000 lei building in an urban area and has not revalued it in the last three years, with a 10% tax rate:

$$\begin{aligned} \text{tax} &= \text{inventory value} \times 10\% \\ &= 2.000.000.000 \times 10\% \\ &= 200.000.000 \text{ lei} = 20.000 \text{ RON (considering the denomination)} \end{aligned}$$

4.4. The period 2016–present

Starting from 2016, building taxation has been governed by Law no. 227/2015, which introduced Romania's new Fiscal Code. According to this regulation, the applicable tax rates vary:

For residential buildings owned by individuals: 0.08% to 0.2%

For non-residential buildings: different rules and higher rates apply, depending on ownership and evaluation.

Table no. 5 Taxable Values According to Building Type and Utilities (Law no. 227/2015)

No.	Type of buildings and other taxable constructions	Taxable amount ** (lei / m ²)	
		With water, sewerage, electrical, heating-cumulative conditions	Without water, sewerage, electrical, heating installations
0	1	2	3
1.	Buildings		
a)	with walls or frames of reinforced concrete walls of burnt brick, natural stone or other materials, without frames of reinforced concrete	1000	600
b)	with wooden walls, unburned brick, wadding, cobwebs and other similar materials	300	200
2.	Outbuildings, located outside the main body of the building:		
a)	with walls of burnt brick, stone, concrete or other similar materials	200	175
b)	with wooden walls, unburned brick, cobwebs, wadding etc.	125	75
3.	For homes located in the basement, basement or attic	The value represents 75% of the value corresponding to each group of buildings	

4.	For spaces with another destination, located in the basement or basement of buildings	The value represents 50% of the value corresponding to each group of buildings

Source: The taxable values on m.p. according to Law 227/2015

In accordance with Article 457 (7) and (8) of Law no. 227/2015, the taxable value of a building is reduced depending on its age or the date of the last consolidation, modernization, alteration, or extension, as follows:

- 50% reduction for buildings older than 100 years
- 20% reduction for buildings between 50 and 100 years old
- 10% reduction for buildings between 30 and 50 years old

Under Article 458 (1) of the New Fiscal Code, the tax for non-residential buildings owned by individuals is calculated by applying a tax rate of 0.2% to 1.3% to one of the following values:

- The value determined by a certified evaluator's report prepared within the last 5 years
- The final value of construction works for buildings erected within the last 5 years
- The value listed in the deed of transfer for buildings acquired in the last 5 years

For legal entities, according to Article 460, the tax is also applied between 0.2% and 1.3% of the building's taxable value.

Example 1 (individual):

For the same 100 m² residential building constructed in 1982, located in a rural area and owned by a natural person, with a tax rate of 0.1% and a 10% correction coefficient:

$$\begin{aligned}\text{tax} &= \text{taxable amount} \times \text{no sqm} \times 1,1 \times 0,1 \% \\ &= 600 \times 100 \times 1,1 \times 0,1 \% \\ &= 66.000\text{lei} \times 0,1 \% = 66 \text{ ron}\end{aligned}$$

Example 2 (legal entity):

For a legal entity owning a building with an inventory value of 200,000 lei in an urban area, and with a 1.3% tax rate:

$$\begin{aligned}\text{tax} &= \text{inventory value} \times 1,3 \% \\ &= 200.000 \times 1,3 \% \\ &= 2.600 \text{ ron}\end{aligned}$$

5. Conclusion

The evolution of building taxation over the last two decades can be summarized in the table below, comparing values for individual and legal taxpayers across legislative periods:

Table no. 6 Comparative Tax Values by Period and Taxpayer Type

No.	Period of time	Individual tax value Hers	Value of legal entity tax B
1	1994-2001	1	3.000
2	2002-2003	34	10.000
3	2004-2015	56	20.000
4	2016-2020	66	2.600

Source: The taxable values on m.p. according to Law 227/2015

As shown in the table, tax values have increased progressively over time. The most substantial rise occurred following the enactment of Government Ordinance no. 62/2002, where there was a 3,400% increase for individuals and a 333% increase for legal entities. This trend continued under the two successive fiscal codes.

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Less Cash, Same Shadow? Payment Trends and Informality in the European Union

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Abstract

In the context of accelerating digitalisation, the transition from cash to electronic payments is often perceived as an effective means of reducing the shadow economy. This study analyses the evolution of payment behaviour in the European Union as a whole between 2018 and 2022 and its relationship with two key indicators of tax compliance, the shadow economy and the VAT Gap. Based on data provided by the European Central Bank, the European Commission and the European Parliament, payment indicators are calculated and correlations are analysed. The results confirm a close link between the growth of digital payments and the reduction of the VAT Gap, but do not indicate a proportional decrease in the shadow economy. The study contributes to the literature by providing an integrated analysis at the level of the European Union as a whole and reinforcing the hypothesis that digitalisation is necessary but not sufficient to combat economic informality. Furthermore, possible adverse behavioural reactions to imposed digitalisation, which may contribute to the persistence of the shadow economy, are discussed.

Key words: digital payments, shadow economy, cash usage, VAT Gap, fiscal compliance

J.E.L. classification: E26, H26, O17, O33

1. Introduction

In recent decades, the digitalization of national economies has profoundly redefined the way in which individuals and companies conduct transactions. In particular in the European Union, the accelerated transition to electronic payments, through debit or credit cards, e-money and mobile applications, has been actively supported. This happened with the help of public policies, technological transformations and behavioural changes, generated by recent crises, such as the COVID-19 pandemic. In parallel, cash remains a relevant payment instrument, especially among vulnerable categories or in sectors of the shadow economy. The relationship between the structure of payments and the size of the shadow economy thus raises important economic and fiscal questions. To what extent does reducing the use of cash lead to a decrease in economic informality? Can the digitalization of payments be an effective tool to combat tax evasion or are complementary interventions needed?

This article investigates these issues through a quantitative analysis applied to the European Union. The main objective is to assess the link between citizens' payment behaviour and tax compliance indicators, such as the shadow economy and the VAT Gap. Starting from the specialized literature and using official data from the period 2018-2022, the study proposes a critical interpretation of the real influence of digitalization on economic informality. At the same time, it provides arguments for the formulation of more nuanced public policies.

Despite the increased attention paid to the relationship between the digitalization of payments and the shadow economy, little research provides a comparative quantitative analysis applied exclusively to the European Union in the post-pandemic period. The present study fills this gap by using harmonized official data and simultaneously analysing payment behaviour and tax compliance.

2. Literature review

Cash is often seen in public discourse and recent literature as a key enabler of tax evasion and a symbol of the shadow economy. This view has driven policies promoting digital payments and restricting cash use. However, such measures are sometimes seen as overly controlling, causing public resistance and slowing the adoption of digital tools. Despite tighter regulations, tax evasion and informal economic activity persist, highlighting the need for more flexible strategies (Aivaz et al., 2024a, p. 3; Munteanu et al., 2024, p. 4). Corruption, including bribery and influence peddling, adds further complexity (Florea & Aivaz, 2022b, p. 329). As digitalization accelerates, the debate over cash versus digital payments intensifies. While digital options expand, cash remains a staple for some. In the Netherlands, 7% of citizens use cash exclusively, and 28% say they cannot give it up, citing cost control and security (van der Crujsen & Reijerink, 2023, pp. 2–6). However, its use also fosters hidden economic activities.

The shadow economy includes all economic activities that contribute to GDP but are deliberately hidden, to avoid taxes and regulations (Reimers et al., 2020, p. 8). While cash enables such activity due to its untraceability, eliminating it wouldn't end informality, as other untraceable methods may emerge (Reimers et al., 2020, p. 18). Seitz et al. (2020) empirically investigated the relationship between cash in circulation and the shadow economy in euro area countries. The authors concluded that only medium-value banknotes (50 and 100 euros) are significantly and positively correlated with the shadow economy and only in smaller economies. For high-value banknotes, the effect is insignificant or negative. For small ones, there is no clear relationship (Seitz et al., 2020, p. 17).

To measure tax evasion, as part of the phenomenon of the shadow economy, the VAT gap (the difference between the theoretical and the actual VAT collected) is frequently used, reflecting losses from tax non-compliance (Bohne et al., 2023, p. 2). The study done by Bohne et al. (2023, p. 14) shows that a 1 p.p. increase in e-money as a percentage of GDP reduces the VAT gap by 1.4 p.p. During the pandemic, a 5.5% increase in digital payments led to an 11.9% reduction in evasion. In addition, an 8% decrease in cash use was associated with a 31% reduction in the VAT gap (Bohne et al., 2023, p. 17). However, digitalization does not automatically guarantee a reduction in the shadow economy. In Poland, although electronic payments have increased significantly, the shadow economy has continued to grow after 2020, influenced by the COVID-19 crisis, the war in Ukraine and fiscal instability (Kowal-Pawul and Lichota, 2024, p. 138). The authors emphasize that digitalization is a necessary but not sufficient condition if it is not supported by institutional trust and coherent policies (Kowal-Pawul and Lichota, 2024, pp. 133, 139).

In South Asia, Syed et al. (2021, pp. 9–10) show that a 1% increase in mobile transactions and ATMs reduces the informal economy by 0.092% and 0.081%, respectively. As highlighted by Ahmad et al. (2024, p. 121), regional dynamics such as digital infrastructure maturity and levels of financial inclusion significantly influence the effectiveness of digital tools in improving tax revenue. In India, although electronic payments have increased, cash remains dominant due to precautionary reasons and limited access in rural areas (Panda and Priya, 2024, pp. 2080–2087). In the same context, Lawrence and Anand (2025, pp. 2–6) highlight that cultural resistance and perceived barriers can slow the adoption of new technologies. At the same time, among young people, the adoption of mobile payments is strongly influenced by factors such as perceived usefulness, social pressure, infrastructure and trust in digital services. A study conducted on a sample of young Indonesians shows that trust and perceived ease are decisive factors in the intention to use mobile payments (Nur and Panggabean, 2021, pp. 22–23).

Globally, Birigozzi et al. (2025, pp. 1, 6) show that a 1 p.p. increase in the adoption of digital payments can accelerate the GDP growth rate by 6–8%, through transparency and efficiency. In Yemen, weak digital infrastructure reduced the positive impact of these tools, despite existing adoption intentions (Alduais and Al-Smadi, 2022, pp. 8–10). In Pakistan, digital payments reduced the cash conversion cycle and increased spending frequency (Rehman et al., 2025, p. 134). In Hungary, lack of financial awareness slows down the transition to digital payments (Pintér et al., 2022, pp. 2–13), and in Jordan, electronic payments indirectly contribute to reducing informality by decreasing uncertainty (Alkhwaldi et al., 2023, pp. 19–20). In Indonesia, the use of digital subsidies can support transparency, but success depends on digital infrastructure and education (Wibowo and Hariadi, 2025, pp. 68–85). In conclusion, digital payments can help reduce the shadow economy, but

only as part of a broader effort that includes clear fiscal policies, a strong digital infrastructure, and increased trust in institutions.

Although the literature extensively analyses the relationship between payment digitization and the shadow economy in various regions of the world, there are few studies that address this link from a comparative and quantitative perspective, applied exclusively to the European Union as a whole, based on recent official data on the structure of transactions. The present study fills this gap through an integrated analysis that simultaneously tracks the evolution of payment behaviour and its impact on tax compliance indicators in the post-pandemic European context.

3. Research methodology

The study uses a descriptive-analytical approach to investigate the link between the digitalization of payments, the use of cash and the evolution of the shadow economy in the European Union. Given the article's aim to provide a synthetic EU-wide overview in the post-pandemic context, the time frame 2018 - 2022 is considered appropriate for highlighting key behavioural trends. The analysis is based on official data provided by the European Central Bank (for transaction volumes and values), the European Parliament (for estimates of the informal economy) and the European Commission (for reporting on the VAT Gap). Data processing and calculations were performed in Microsoft Excel.

Relevant indicators of payment behaviour were constructed, such as the share of cash in total transactions (Cash Share), the share of POS transactions (POS Share) and e-money transactions (E-money Share), as well as the average value per transaction for each type of payment instrument. In parallel, the evolution of the shadow economy and the VAT Gap were monitored to assess possible links between the digital transition and the level of tax compliance. Correlations between variables were measured using the Pearson coefficient, to identify positive or negative association patterns.

The Cash Share, POS Share and E-money Share weights were calculated individually, as ratios between the share of the total number of cash withdrawals (ATM and Over the Counter), the share of POS payments and the share of E-money payments and the total transactions made through all payment methods analysed (cash + POS + e-money). The Cash Share indicator is used as a proxy for *cash dependence* at the aggregate level and allows a coherent comparison with the dynamics of other forms of payment in the economy.

4. Findings

The empirical analysis highlights the contrast between the rapid development of digital payments in the European Union and the persistence of the shadow economy over the same period. Although the use of cash has decreased significantly and electronic instruments have become increasingly common, indicators of economic informality and the VAT collection gap do not reflect a proportional reduction. The results detail these trends and provide an integrated interpretation of the phenomenon. The first table (Table no. 1) highlights the gradual transition of payment behaviour in the European Union over the period 2018–2022.

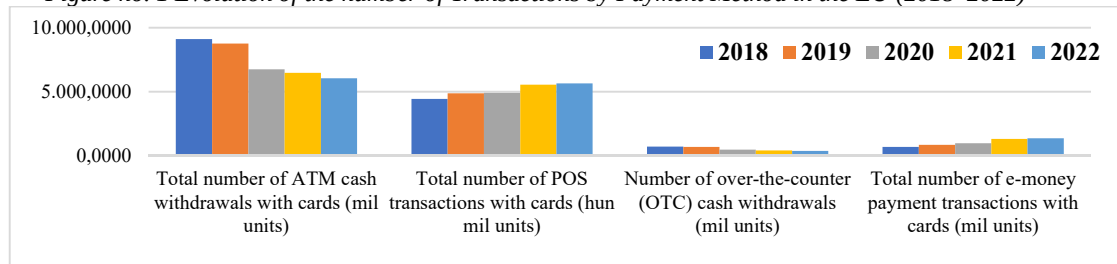
Table no. 1 EU number of Transactions by Payment Method (2018–2022)

EU (27)	Total Number of ATM cash withdrawals with cards (mil units)	Total Number of POS transactions with cards (hundred mil units)	Total Number of OTC cash withdrawals (mil units)	Total number of e-money payment transactions with cards (mil units)
2018	9,110.9700	4,426.3218	715.6790	669.7780
2019	8,755.5380	4,877.4829	679.5090	839.8000
2020	6,742.5910	4,911.8667	465.3590	971.5490
2021	6,481.7040	5,544.8538	405.0580	1,313.4930
2022	6,042.3540	5,649.0150	364.0350	1,362.3730

Source: Data from the European Central Bank (ECB), available at <https://data.ecb.europa.eu>

A steady decline in cash withdrawals from ATMs and over-the-counter (OTC) is observed, in parallel with a significant increase in the number of transactions made with cards at POS and those made through electronic money (e-money). These developments indicate a clear shift towards the digitalization of payments, which seems to have accelerated especially in the post-pandemic period.

Figure no. 1 Evolution of the number of Transactions by Payment Method in the EU (2018–2022)



Source: Data from the European Central Bank (ECB), available at <https://data.ecb.europa.eu>

The first chart (Figure no. 1) shows a clear shift in EU payment behaviour. From 2018 to 2022, ATM withdrawals fell by a third and counter withdrawals halved, indicating reduced cash use. Meanwhile, POS card transactions rose sharply, and e-money payments doubled, reflecting growing preference for digital methods, accelerated by the pandemic.

This evolution suggests a structural transformation in consumer preferences, increasingly favouring speed, convenience, and traceability. However, the fact that cash does not completely disappear from the transactional landscape indicates its residual function. A function possibly linked to high-value or less fiscally visible payments. Thus, the digitalization of the payment system reflects an important technological advance, but it remains to be seen to what extent this change actually contributes to reducing the shadow economy.

Table no. 2 Share of Cash, POS, and E-money in Total Transactions, Shadow Economy and VAT Gap (EU, 2018–2022)

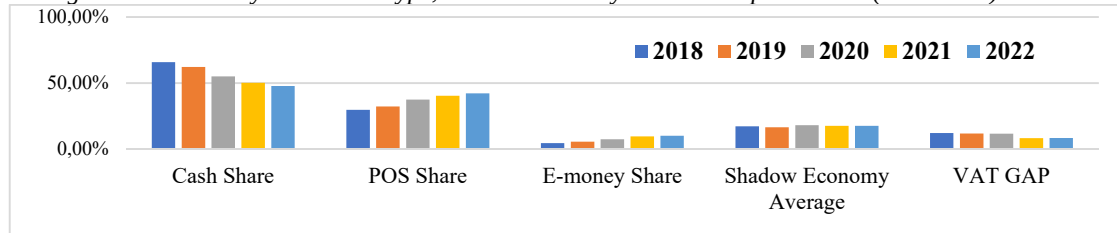
EU (27)	Cash Share	POS Share	E-money Share	Shadow Economy	VAT GAP
2018	65.85%	29.66%	4.49%	17.22%	12.13%
2019	62.27%	32.19%	5.54%	16.52%	11.79%
2020	55.06%	37.52%	7.42%	18.13%	11.53%
2021	50.10%	40.34%	9.56%	17.68%	8.29%
2022	47.75%	42.10%	10.15%	17.64%	8.35%

Source: Own calculations based on European Central Bank data; European Parliament; European Commission VAT Gap Report

The second table (Table no. 2) provides a synthetic picture of the evolution of the payment structure in the European Union and its relationship with two key indicators of tax compliance, the shadow economy and the VAT Gap. A constant decrease in the share of cash in total transactions is observed, from 65.85% in 2018 to 47.75% in 2022, in parallel with a visible increase in POS payments (from 29.66% to 42.10%) and e-money payments (from 4.49% to over 10%).

This change confirms the trends in the previous graph and supports the idea that digital payments are gaining ground at an accelerated pace. However, the size of the shadow economy remains relatively stable, with values between 16.5% and 18% of GDP, while the VAT Gap records a clearer improvement, decreasing from 12.13% in 2018 to 8.35% in 2022. These data suggest that digitalization indeed contributes to better VAT collection, but is not sufficient, in itself, to reduce the shadow economy in the European Union, which seems to be influenced by deeper factors such as trust in institutions, the state's control capacity and tax culture.

Figure no. 2 Share by transaction type, Shadow Economy and VAT Gap in the EU (2018-2022)



Source: Own calculations based on European Parliament; European Commission VAT Gap Report; European Central Bank

The second chart (Figure no. 2) summarizes the evolution of the shares of different payment methods in total transactions, along with the size of the shadow economy and the VAT collection gap over the period 2018–2022. A clear trend of replacing cash with digital payments is noticeable. The share of cash decreases by over 18 percentage points, while POS and e-money transactions are steadily gaining ground. In contrast, the shadow economy remains practically unchanged, despite digital progress, which suggests that economic informality is less influenced by means of payment and more by structural factors. The only indicator that responds sensitively to the increase in digitalization is the VAT Gap, which registers a visible decrease. This suggests that electronic payments clearly contribute to more efficient VAT collection, but are not a universal remedy for combating the shadow economy.

Table no. 3. Correlation Between Payment Method Shares, Shadow Economy, and VAT Gap

Correlation Pair	Cash Share vs Shadow Economy	POS Share vs Shadow Economy	E-money Share vs Shadow Economy	Cash Share vs VAT Gap	POS Share vs VAT Gap	E-money Share vs VAT Gap
Results	-0.6205	0.6393	0.5764	0.9052	-0.8869	-0.9393

Source: Own computations via Excel and ECB, European Parliament, and European Commission data

The third table (Table no. 3) provides an important statistical insight into the relationship between payment behaviour and indicators of tax evasion and economic informality in the European Union. While the correlations observed are based on a limited time frame, they are sufficiently robust to suggest relevant patterns in support of the article's exploratory objective.

First, we observe a very strong positive correlation between Cash Share and VAT Gap ($r = 0.9052$). This means that as cash use decreases, the VAT collection gap tends to decrease. This result supports the idea that the digitalization of payments has a real and measurable impact on tax efficiency, as electronic transactions are easier to track, report and control by tax authorities. Additionally, both POS Share ($r = -0.8869$) and E-money Share ($r = -0.9393$) show strong negative correlations with the VAT Gap, confirming that where digital payment methods are more widely used, more VAT is collected and with fewer losses.

In contrast, the relationship between the payment structure and the shadow economy is much more nuanced and even counterintuitive. For example, POS Share has a moderate positive correlation with the shadow economy ($r = 0.6393$). The correlation between shadow economy and E-money Share ($r = 0.5764$) shows a similar trend. This may suggest that the digitalization of payments is not a direct antidote to economic informality, as the shadow economy includes a much broader range of activities (undeclared employment, unbilled services, unreported income, etc.), which are not necessarily related to the payment method. A possible complementary explanation could be the rejection reaction from certain segments of the population, who perceive the forced transition to digital payments as a form of excessive control. In such cases, imposed digitalization without real social acceptance may cause a *retaliation* effect. In this case, taxpayers deliberately choose to avoid formal systems and take refuge in the shadow economy, thereby increasing participation in untraceable activities. Thus, despite the fact that people pay more by card, a significant part of economic activity may remain undeclared.

Moreover, the negative correlation between Cash Share and Shadow Economy ($r = -0.6205$) seems paradoxical at first glance. It would seem that, in the observed years, the decrease in cash use coincided with a slight increase in the shadow economy (e.g. 2020, pandemic context). This is where the importance of the institutional and socio-economic context comes in. In the absence of an efficient system of tax inspection, transparency, trust in authorities and real sanctioning, even the most advanced digital tools can be used for informal purposes.

Therefore, the conclusion that emerges is a balanced but profound one. Digitalization clearly contributes to reducing tax losses through VAT, but it does not guarantee the reduction of the shadow economy in the absence of coherent policies, a strong institutional framework and a high degree of voluntary compliance among taxpayers. This underlines the need to view the informal economy as a systemic phenomenon, not just as a cash issue.

Table no. 4 Total Value of Transactions by Type (EUR million, EU, 2018–2022)

EU (27)	Total value of ATM cash withdrawals with cards (mil Eur)	Total value of POS transactions with cards (mil Eur)	Value of over-the-counter (OTC) cash withdrawals (mil)	Total value of e-money payment transactions with cards (mil Eur)
2018	1,339,815.9780	1,630,589.0660	703,829.2230	25,134.1030
2019	1,340,277.7220	1,703,940.2010	732,819.1370	29,706.3320
2020	1,176,878.6990	1,695,390.9180	565,798.4920	35,452.9480
2021	1,195,893.2590	1,853,234.1620	533,624.3000	47,520.7710
2022	1,150,475.7430	1,975,354.8110	545,832.0830	40,899.8970

Source: European Central Bank, <https://data.ecb.europa.eu>

The fourth table (Table no. 4) completes the overall picture of payment behaviour in the EU, highlighting the evolution of the total value of transactions by type of instrument between 2018 and 2022. While the value of cash withdrawals (ATM and OTC) decreased moderately over the period, the value of POS payments increased steadily, exceeding EUR 1,975 billion in 2022. E-money payments, although still relatively small in total volume, experienced the most dynamic percentage growth, almost doubling the value from 2018. This evolution suggests that, although cash remains important in absolute terms, digital payments are also gaining ground in terms of the economic value transacted, not just frequency, thus consolidating their role in the formal economy.

Table no. 5 Average Value per Transaction by type of transaction (EUR, EU, 2018–2022)

EU(27)	Average Value Transaction ATM Withdrawal	Average Value Transaction POS	Average Value Transaction OTC Withdrawal	Average Value Transaction E-Money
2018	147,0553	368,3847	983,4426	37,5260
2019	153,0777	349,3483	1.078,4539	35,3731
2020	174,5440	345,1622	1.215,8323	36,4912
2021	184,5029	334,2260	1.317,4022	36,1789
2022	190,4019	349,6813	1.499,3945	30,0211

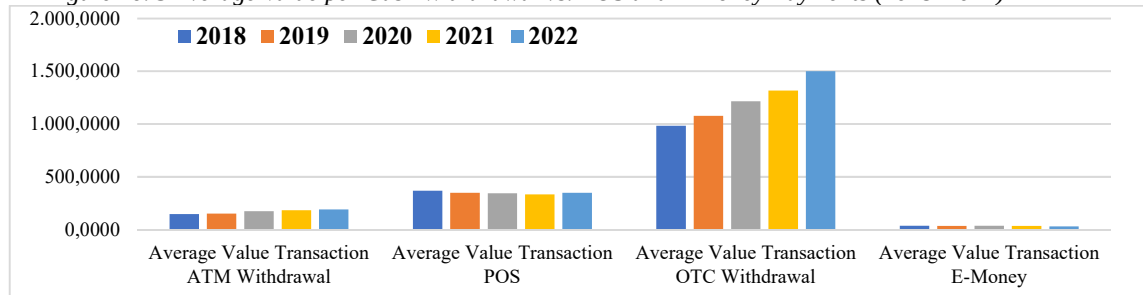
Source: Own calculations based on European Central Bank

The fifth table (Table no. 5) provides a revealing perspective on the evolution of the average value per transaction for the main payment methods in the EU. A consistent increase in the average value of cash withdrawals is observed, both at ATMs (from EUR 147 to EUR 190) and, especially, at counters (OTC), where an increase of over 50% was recorded, reaching almost EUR 1.500/transaction in 2022. In contrast, the average value of POS transactions remains relatively stable, and that of e-money payments even decreases slightly. This fact confirms the character of these instruments as preferred for fast, low-value payments, such as online services, transport or immediate consumption.

This variation in average transaction values suggests that each payment method serves distinct purposes, with cash retaining relevance in higher-value transactions. Thus, it is not the frequency of cash use that is relevant, but rather the context and value of the payments in which it is involved. In

a scenario where cash is used mainly for large and occasional transactions, suspicions of circumvention of official reporting systems may arise. This dynamic suggests that tax policies should target the typology of cash transactions rather than banning the means of payment per se.

Figure no. 3 Average Value per Cash Withdrawal vs. POS and E-money Payments (2018–2022)



Source: Own calculations based on European Central Bank

These trends (Figure no. 3) suggest that cash is being used less for everyday expenses and more for large-value payments, possibly outside the formal tax circuit. Therefore, the policy of reducing the use of cash needs to be nuanced. In this context, the problem is not necessarily the existence of cash in the economy or the number of cash transactions, but its use outside transparent channels. Fiscal policies aiming to eliminate cash entirely, risk unfairly penalizing citizens who are not involved in informal activities. All while sophisticated forms of evasion, operating with large amounts, could persist in the absence of effective institutional supervision.

5. Conclusions

The data analysed confirms an undeniable reality. The European Union is in an accelerated process of transition to digital payments. The use of cash is constantly decreasing, both in frequency and as a proportion of total transactions, while cards and electronic payments are becoming the norm. This transformation is visible in all the graphs and tables presented and reflects an increasingly modern economic behaviour, influenced by digitalization and convenience, with the help of public policies.

However, this *digital revolution* does not automatically translate into a significant reduction in the shadow economy. Although the VAT gap has clearly narrowed, indicating greater efficiency in tracking and taxing official transactions, the size of the shadow economy has remained virtually unchanged. Thus, the study shows that digitalization helps to collect taxes more efficiently, but does not eliminate the root causes of evasion and informality, such as undeclared work, institutionalized fraud or lack of trust in authorities. Digitalization must be accompanied not only by infrastructure, but also by effective public communication and measures that increase voluntary acceptance. Otherwise, it risks generating adverse reactions and informal behaviours as a form of resistance. This behavioural dimension, often ignored in tax policies, could be part of the explanation to why, despite digital progress, the shadow economy does not decrease proportionally. Additionally, the COVID-19 pandemic created new vulnerabilities, as shown by the increase in economic crimes at the European level, requiring coordinated institutional responses (Florea & Aivaz, 2022c, p. 4). Thus, institutional pressure to eliminate cash, if not accompanied by social legitimacy, can fuel a downward spiral of distrust and tax avoidance. Moreover, the increase in the average value of cash transactions, especially those withdrawn over the counter, indicates a selective use of cash for large amounts, which could be associated with informal activities that are difficult to detect through simple automation of payment systems. Thus, the problem is not necessarily cash itself, but the context in which it is used.

The main conclusion of this article is therefore that the digitalisation of payments clearly contributes to reducing tax losses, but it is not a complete solution to combat the shadow economy. Sustainable tax compliance requires integrated policies, adapted to the institutional context of each country. These should also include investments in human capital, as education and professional development are key to fostering ethical behaviour and institutional engagement (Aivaz et al., 2024b,

p. 13). To truly combat the shadow economy, public policies should not focus exclusively on limiting the use of cash, but rather pursue strategic directions capable of discouraging systemic evasive behaviour. Instead of targeting the average citizen who uses cash for everyday needs, interventions should be calibrated to identify and control high-value, opaque transactions, often carried out outside the tax circuit. This requires strengthening administrative capacity, improving audit and reporting systems, and the selective application of smart tax policies, targeting areas with high risk of evasion, as illustrated by DGAF's structured approach to combating tax fraud through targeted audits and risk-based inspections in Romania (Aivaz et al., 2022c, p. 346; Florea & Aivaz, 2022a, p. 329; Aivaz et al., 2023, p. 944). Combating the shadow economy is ultimately a matter of governance, not just technology.

Therefore, the study achieved its objective of assessing the link between payment behaviour and tax compliance indicators in the European Union, providing an integrated analysis at the aggregate level and contributing to the nuanced understanding of the relationship between digitalization and economic informality. The results are in line with those presented by Bohne et al. (2023) and Syed et al. (2021), which confirm the positive impact of electronic payments on reducing the VAT Gap. At the same time, they support the conclusions of Reimers et al. (2020) on the complexity of the relationship between cash and the shadow economy. In contrast, the data partially contradict the hypothesis of a simple negative correlation between digitalization and informality, supported by Birigozzi et al. (2025), suggesting that the effects are much more dependent on the institutional context, as also indicated by the analysis carried out by Kowal-Pawul and Lichota (2024). Thus, the study contributes to the scientific literature by highlighting the limits of uniform policies and emphasizes the need for differentiated and sustainable interventions.

Although the European Union operates through a common framework of policies and regulations to which all Member States must adhere, it should not be ignored that each country remains, in essence, an autonomous entity, with its own economic particularities, successes and vulnerabilities. Thus, the overall picture of the Union is an average of these distinct national realities. Common policies often have to be calibrated according to the structural and institutional diversity of each Member State. Member States are positioned differently across the entire development spectrum, from those with high-performing systems aligned with European standards, to those in urgent need of reforms to improve efficiency and institutional coherence. To ensure coherent development across the European Union, comprehensive public policies should foster the growth of less developed states, supported by the more advanced ones (without impeding their own progress), within a solidarity-based framework that delivers for everybody mutual benefits. For future research, a disjunct analysis of Member States according to digital infrastructure and fiscal culture is recommended. This can help to identify more clearly the conditions under which the digitalisation of payments produces visible effects on the shadow economy. Also, the integration of indicators on institutional trust would help refine the explanations for the persistence of informality in certain regions of the Union.

In conclusion, while the transition to digital payments clearly enhances VAT collection efficiency across the EU, the persistence of the shadow economy underlines the need for multi-dimensional strategies, ones that extend beyond technology to address institutional trust, behavioural incentives, and structural vulnerabilities. This study offers a concise yet meaningful contribution to understanding the boundaries of digitalisation's impact on informality and highlights the importance of tailored, context-aware public policy design.

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Beyond Percentages: What Does Inflation Say About Romania?

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Abstract

Inflation is a common economic phenomenon, which significantly influences the functioning and stability of the economy of any country. Even though the effects of inflation may vary from period to period, depending on the economic policies applied and the ability of governments to manage this phenomenon, high inflation values cause major imbalances in a country's economy, with economic and social consequences. This article analyzes the dynamics of this phenomenon in Romania during the period 2014-2024, how prices evolved through the Consumer Price Index and a comparison of the situation in our country with the European Union average. Inflation is not just a percentage, but is a reality that conditions the consumption habits, lifestyle, decisions and social perspectives of an entire generation.

Key words: inflation, purchasing power, consumer price index, the cost of living

J.E.L. classification: E31, E52

1. Introduction

Inflation is an extensive macroeconomic process which, depending on the severity and nature of the factors involved, has various consequences on national economies. Basically, inflation consists of a generalized increase in prices, simultaneously with a decrease in the purchasing power of money. A high and prolonged level of inflation is most often the result of a relaxed monetary policy. If the level of the money supply is too high in relation to the volume of transactions carried out in the economy, then the value of a monetary unit is reduced, or more specifically, the purchasing power of the currency is diminished and prices increase.

Being a complex economic and social phenomenon, identifying and researching the consequences of inflation is not easy, especially since there are numerous causes that can determine the occurrence of inflation. It is one of the controversial topics in the contemporary world, this phenomenon being present in all countries (Dobrea et al, 2024, p. 239).

2. Literature review

Inflation is defined as a generalized and sustained increase in prices, costs and a decrease in the purchasing or selling power of a monetary unit, in this way the state manages to cover the higher level of public spendings compared to the revenues collected. (Bergman, Hutchison, 2015, p. 95). It is that macroeconomic indicator that highlights whether the mix of fiscal, monetary and legal policies applied have led to the stability of consumer prices, this being one of the primary concerns of a central bank (IMF, 2008, p.29).

Authors Rădulescu et al (2019, p. 175) explain inflation as the process by which an increase in the prices of goods and services occurs, affecting the nominal earnings of employees, but also long-term investments.

Mishkin (2015, p. 301) mentions that inflation reduces the purchasing power of nominal wages, therefore if the rate of wage growth is not at least at the same pace as inflation, this will affect the standard of living of employees.

Other authors explain that every time currency is created and put into circulation on the market, in a situation where the real needs for the production of goods are exceeded, at that moment there is an abnormal, artificial monetary situation, called inflation (Anghelache, Sacală, 2015, p.6).

There are several types of inflation, depending on the causes that determined the emergence of this macroeconomic phenomenon. If we look at it from the perspective of intensity, the following forms are highlighted: *low inflation* – in which the price increase does not exceed an annual rate of 3-4%, being considered controllable by banks and specific to highly developed countries; *mild inflation* – a situation in which the price increase is up to 10%, affecting purchasing power, but it is not the case of major destabilization; *galloping inflation* – when the price increase rate is between 10% -100%, with a strong destabilizing effect, a significant depreciation of the national currency, a sudden decrease in purchasing power, uncertainty in the market; *hyperinflation* – when the purchasing power of money collapses, the annual rate of price increase being over 100% (or over 50% in a month). (Samuelson, Nordhaus, 2017, pp. 562).

Due to the multitude of negative consequences on economic development and society in general, most states affected by the inflationary phenomenon implement measures to combat or mitigate the effects of this phenomenon, which represent one of the key objectives of macroeconomic policies. Indirect economic policy measures target both the size and dynamics of aggregate demand (through the use of monetary or fiscal policy instruments) and the size and dynamics of aggregate supply (structural reforms, subsidies). (Mishkin, 2019, p. 315).

3. Research methodology

The first part of the paper presents the theoretical notions regarding inflation and its types and in the second part is analyzed the evolution of inflation in our country, specifying the economic and social effects. The research involved a descriptive and comparative quantitative analysis, using official secondary data published by the National Bank of Romania, the National Institute of Statistics and Eurostat in the period 2014-2024. In order to track the level of inflation in Romania, the evolution of the consumer price index was analyzed, on the main consumption components: food, non-food products and services and in order to compare Romania with the European Union average from the inflation perspective, the harmonized index of consumer prices was used.

4. Findings

The measurement of inflation, the intensity and evolution of this macroeconomic phenomenon is based on a consumer price index which measures the average increase in prices for a "consumption basket" of goods and services, purchased by households in a certain period of time.

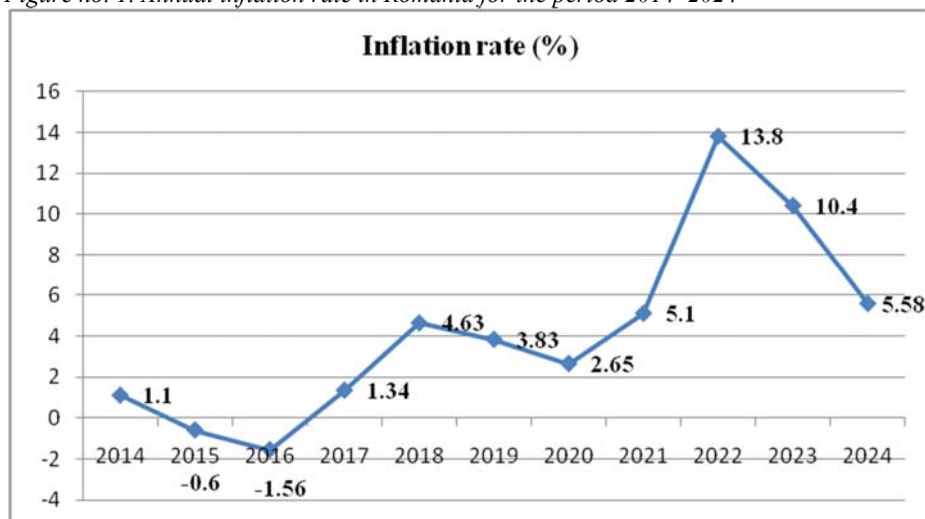
In Romania, the main components of the consumer basket that is the basis for determining the CPI are food, non-food goods and services. These product categories have different weights, for example in our country food products have a higher weight in the consumer basket compared to the average at the European Union level, which means that an increase in the price of these product categories affects the standard of living more.

The cost of living of consumers highlights the average expenses necessary for a decent living and is influenced by the prices of the many goods and services that they currently purchase, but also by the weight of each product in the family budget.

During the analyzed period 2014-2024, inflation in Romania had an oscillating evolution, the interval can be divided into 3 important phases. During the period 2014-2016, the inflation rate decreased from 1.1% to -1.56% (deflation phenomenon). Among the main causes of the decrease, can be mention the reduction of VAT (the general one from 24% to 20% and the one for food to 9%), the maintenance of a controlled consumption after the economic crisis, reduced global prices for energy and oil.

During the period 2017-2019, the inflation rate increased to 4.63% as a result of a fiscal relaxation policy. There were increases in salaries in the budgetary sector, pensions were increased (without being accompanied by sustainable economic growth).

Figure no. 1. Annual inflation rate in Romania for the period 2014–2024



Source: own processing from the data at www.insse.ro [Accessed on 14.03.2025]

In the period 2020-2024, the inflation rate reached a record level of 13.8% (2022) based on external shocks such as the Covid-19 pandemic (when there were disruptions in supply chains, resulting in higher production and transportation costs), the increase in the price of fuel, electricity, gas (in the period 2021-2022 the European energy crisis took place), but also the war in Ukraine, which caused an increase in the prices of cereals, fertilizers, energy. As internal causes, we can mention the depreciation of the national currency against dollar and euro, high budget deficits, the wage-price spiral with pressure on salaries in the private sector.

The table below presents the consumer price index for the 3 components of the consumer basket in Romania, at the end of 2024, with the reference year 2015=100. Over the past nine years, consumer goods prices in Romania increased by 59%.

Table no. 1 Consumer price index in Romania

Category	CPI Current Period 2024	CPI Reference period 2015
Food products (%)	169,68	100
Non-food goods (%)	156,63	100
Services	147,30	100
Total	159,00	100

Source: <http://statistici.insse.ro/> [Accessed on 14.03.2025]

During this period, prices for food products (32.91% share in the consumer basket) increased by approximately 67%, non-food goods (clothing, household products, furniture, household items), which have a share of 48.58% in the consumer basket, increased by 55%, while services such as transportation, telephony, restaurants (18.51% of the consumer basket) experienced an increase of 46%.

The increase in the CPI has strong, varied and complex consequences on the functioning of an economy, on people's lives and on society in general. The increase in prices of products and services affects all social categories, but especially people with low or fixed incomes (pensioners, people from rural areas, creditors). For example, from January 1st, 2023, the pension point was indexed by 12.5%, but the annual inflation rate in 2022 was 13.8%, and in December 2022 it reached a level of 14.1%. Therefore, the increase in pensions was below the pace of inflation, which means that the purchasing power of pensions decreased by 1.3 percentage points.

Also in the case of nominal incomes, their growth rate is not the same as that of inflation, so the economic situation of the population worsens. The purchasing power or real income of the population decreases, people will have less money for consumption, therefore small businesses or local services will also be affected. Less is consumed, the demand for premium products decreases, practically the standard of living decreases. Another consequence is the existence of a tense labor market, in which employees put wage pressure, but this means a cost for the employer, therefore benefits can be eliminated, employees can be fired or relocated. Among the social effects can be mentioned distrust in authorities, increased financial anxiety, migration to other more economically stable countries with stable wages.

In order to observe in more detail the consequences of inflation on income and on the cost of living, the evolution of the consumer price index is analyzed by eliminating groups of goods that are not bought and consumed by all people.

Table no. 2 Partial indices determined by eliminating certain categories of elements from the CPI

	December 2024 % - previous month = 100
Total CPI less alcoholic beverages and tobacco	100,30
Total CPI less fuels	100,25
Total CPI less products whose prices are regulated	100,30
Total CPI less vegetables, fruits, eggs, fuels and products whose prices are regulated	100,26
Total CPI less vegetables, fruits, eggs, fuels, products whose prices are regulated, alcoholic beverages and tobacco	100,28
TOTAL	100,29

Source: <http://statistici.insse.ro/> [Accessed on 20.03.2025]

It should be noted that the regulated products include electricity, CFR transport, medicines, thermal energy, natural gas, public urban transport, etc.

The calculation of partial indices by eliminating some categories from the CPI is essential to know the real nature of inflation and to identify the factors that lead to price increases. In this way, core inflation is determined, which highlights permanent trends in an economy, and not temporary ones such as taxes, excise duties or sudden increases in energy prices.

Regarding the evolution of the inflation rate at the European Union level, the data are presented in table no 3. The inflation rate was calculated based on the harmonized index of consumer prices, an indicator used to determine inflation based on a comparable consumer basket in all European Union member countries, using the same calculation method.

Table no. 3 Comparison between the inflation rate in Romania and the EU average

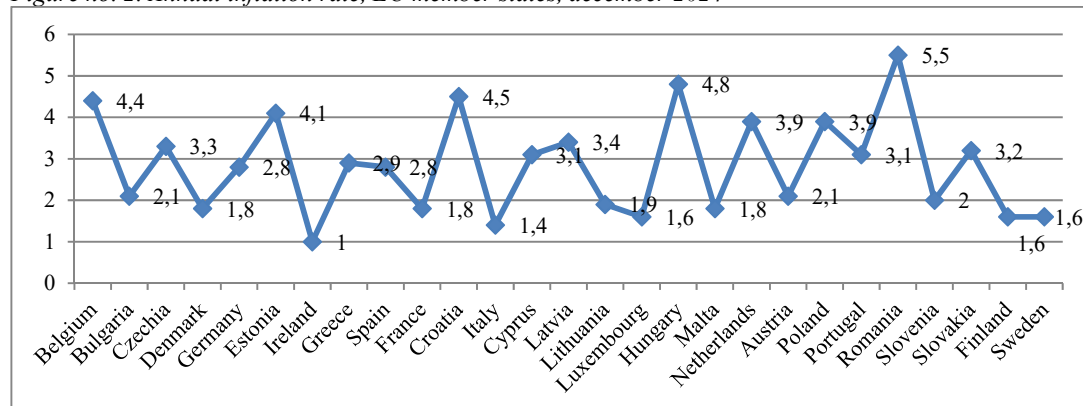
Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
EU average annual inflation rate (%)	0,83	-0,1	-0,2	1,43	2	1,63	0,3	2,9	9,2	6,4	2,7
Annual inflation rate Romania (%)	1,1	-0,6	-1,56	1,34	4,63	3,83	2,65	5,1	13,8	10,4	5,58

Source: own processing based on information from www.eurostat.eu [Accessed on 10.04.2025]

During the analyzed period, the average inflation rate at the European Union level recorded periods of stability, periods in which the deflation phenomenon appeared, but also moments when the inflation level increased significantly as a result of the pandemic and the energy crisis. In 2024, the inflation rate approached the level targeted by the European Central Bank, namely 2%.

Our country recorded the highest level of inflation in the EU in 2024, the value being 5.5%, above the average inflation rate within the European Union, which was 2.7%. High inflation values were also reported in Hungary (4.8%) and Croatia with 4.5%.

Figure no. 2. Annual inflation rate, EU member states, december 2024



Source: www.eurostat.eu [Accessed on 10.04.2025]

Ireland, Italy, Luxembourg, Finland and Sweden are the countries where the lowest annual inflation rates were reported in 2024, below 2%. This can be explained by the implementation of prudent fiscal and monetary policies, the low percentage of energy in the consumption basket (these countries have invested in alternative energy sources), efficient logistics infrastructure (thus avoiding the increase in production and supply costs).

5. Conclusions

Inflation, one of the key macroeconomic variables, has direct effects on economic stability and the standard of living of the population. This indicator is closely monitored by policymakers (government, central bank), but also by the business community, investors and the general public. Together with other essential economic indicators, such as the unemployment rate, economic growth and exchange rate, inflation contributes to drawing an overall picture of the economy and the level of development of a country.

The annual inflation rate is of interest for several reasons. First, it determines the real standard of living. In establishing the purchasing power of the population, it is not sufficient to consider nominal incomes as basis, they must be correlated with the general evolution of prices. Therefore, inflation directly affects the way in which people cover their basic needs, make investments or save. Second, the inflation rate is a correction tool in income policy, being used to adjust pensions and salaries, in order to reduce the negative effects determined by the increase in the price of consumer goods and services.

Beyond the percentages presented, the evolution of inflation over the last decade highlights several aspects about Romania, as an economy and society. From an economic perspective, cyclical imbalances were observed (periods in which demand increased significantly were not accompanied by a proportional increase in domestic supply, which meant pressure on costs and prices) and structural imbalances (essential sectors, such as transport, energy, agriculture, did not have the power to adapt to domestic or external economic changes and the import of raw materials, most often in foreign currency, emphasized the dependence on the exchange rate, with import costs increasing substantially).

Also, the inadequate indexation of pensions has reduced purchasing power, highlighting the difficulty with which the state adjusts spending to economic reality and the problems in maintaining social sustainability without attracting additional fiscal measures. The issue of a higher budget deficit has been raised, in order to be able to finance the costs of salaries and pensions. The practice of a relatively relaxed monetary policy in an inflationary moment is another element that attracts attention. Given the situation of accelerated inflation at a global level, the National bank of Romania has delayed the increase in the key interest rate, which has impacted the exchange rate and savings. Although the upward trend in the inflation rate was visible since mid-2021, the interest rate increase was made in 2022, reaching 7% in 2023, while in other countries (Hungary, Poland, Czech Republic) this measure was implemented much earlier. Another aspect is the erosion

of savings. Since bank interest rates were mostly below the inflation level, the population preferred to invest in real estate, currency or gold.

From a social point of view, we are talking about the deepening differences between social classes (people with low and fixed incomes spend a large part of their budget on food and utilities, those categories of items whose prices have increased the most), about low access to vital services (education, health, inflation influencing their cost), about prudence (the population is more attentive to price developments, more restrained in consumer spending, more distrustful of government commitments), about labor migration (qualified young people prefer to leave for countries where the economy is more stable, inflation is under control, real earnings are more protected and the quality of life is higher.)

It is necessary for our country to align macroeconomic policies in order to maintain price stability, to ensure sustainable growth, to complete convergence with European Union standards (in this regard are necessary fiscal efficiency, financial education, energy modernization). Romania remains a country with high potential, but which must learn to face serious challenges: to stimulate investments, to implement reforms to support a level of inflation appropriate to the country's degree of development, but also stable in the long term and to maintain the population's trust in state institutions.

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Sustainability of Public Water Networks in Romania: Assessment of Failures and Network Expansion

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Abstract

Sustainability in public water infrastructure requires balanced investment, efficient management, and long-term resilience against failure and degradation. This article evaluates the sustainability of public water distribution networks in Romania, based on technical performance indicators from 43 regional operators. The analysis focuses on pipeline failures, distribution network failures, and network length, using hierarchical cluster methods to identify operational differences. Results show notable disparities between operators, with a small number exhibiting high failure rates and infrastructure stress. Most operators fall within a more uniform performance range. These findings underline the importance of differentiated infrastructure strategies and informed investment planning. Such approaches are essential in reducing non-revenue water, improving cost-efficiency, and enhancing service quality. The study contributes to improving decision-making processes for water sector governance, supporting the alignment of technical management practices with sustainability goals and regulatory requirements.

Key words: water distribution networks, technical performance indicators, sustainable infrastructure management, Romania

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

1. Introduction

Access to safe and reliable drinking water is a fundamental component of public infrastructure, with direct implications for health, economic productivity, and environmental management. Water distribution networks (WDNs) ensure the conveyance of treated water from sources to end users, but they remain vulnerable to structural degradation, frequent failures, and operational inefficiencies (Serafeim *et al*, 2024, p.16). Despite improvements in materials, installation methods, and monitoring systems, elevated failure rates and substantial volumes of non-revenue water (NRW) persist in many countries, regardless of development level (Moise, 2024, p.208).

Globally, water losses in WDNs may exceed 30% of the input volume, generating increased operational costs, energy consumption, and risks to service continuity and public health (Tariq *et al*, 2021, p.2). In Romania, these issues are compounded by infrastructure heterogeneity, regional disparities, and varied levels of technical capacity among operators. Although major investments and institutional reforms have been implemented, such as regionalization and EU-funded modernization, performance remains inconsistent (Moise, 2024, p.209; Platon *et al*, 2024, p.658). The sector includes 43 regional public operators and numerous smaller providers, with significant differences in network size, age, and frequency of technical failures.

The persistence of failures is influenced by both external (e.g., geotechnical and climatic) and internal (e.g., network age, materials, hydraulic conditions) factors (Ociepa *et al*, 2019, p.2; Serafeim *et al*, 2024, p.11). Limited capacity for timely leak detection and repair contributes to increased water losses and additional energy usage.

From an economic perspective, NRW results in reduced cost recovery and delayed rehabilitation measures due to budgetary constraints. Romanian regulations allow losses of up to 15% in distribution and 5% in transmission systems, with compulsory upgrades when total losses exceed 20%. These thresholds are often surpassed, particularly in older systems. Consequently, the adoption of economic mechanisms such as pricing strategies and full-cost recovery is promoted to ensure financial and operational sustainability (Platon *et al*, 2024, p.659).

In this context, performance analysis of water operators becomes necessary to support informed decision-making and infrastructure prioritization. The present article aims to evaluate the sustainability of Romania's public water networks by analyzing infrastructure performance, focusing on failure rates and network expansion. Using data from 43 regional operators, the study applies cluster analysis to identify structural differences and operational patterns, with the objective of informing investment planning and aligning management strategies with national and European policy frameworks.

2. Literature review

The sustainability of Romania's public water distribution networks is situated at the intersection of infrastructural resilience, institutional adaptation, and economic rationalization. The literature addressing this topic reveals an intricate interplay of technical degradation, governance constraints, and evolving environmental imperatives. Underpinning much of the current discourse is a recognition that infrastructure failures and suboptimal expansion trajectories are symptomatic of deeper systemic inefficiencies, rooted both in the legacy of underinvestment and the fragmented articulation of policy and financial mechanisms. Understanding of these interdependencies allows for more effective identification of intervention points, where targeted policies and infrastructure investments can produce measurable improvements. Moreover, evaluating sustainability must also include the capacity of operators to manage risks, adapt to regulatory change, and ensure service continuity across varied territorial and institutional settings.

Several authors explore how infrastructural vulnerability undermines water system sustainability. Thus, Aghapoor Khameneh *et al* (2020, p.421) underscore the growing complexity of water distribution networks (WDNs) and the necessity of integrating uncertainty modeling into failure analysis. Their use of fuzzy fault tree analysis (FFTA) is particularly notable, addressing both data scarcity and systemic interdependencies. Tchórzewska-Cieślak *et al* (2023, p.1) reinforce this view, highlighting how factors such as pressure fluctuations, poor hydraulic design, and corrosive soils act cumulatively to accelerate network degradation – issues compounded by insufficient preventive maintenance and a lack of systematic data collection. Moreover, works such as those by Mirea and Aivaz (2016, p.202) and Aivaz (2021a, p.53) emphasize how cost structures and workforce inefficiencies influence long-term infrastructure vulnerabilities.

In the Romanian context, these technical deficiencies intersect with institutional inertia. Moise, Banghiore, and Stan (2024a, p.124) present empirical evidence on the correlation between infrastructure investment levels and performance outcomes in the wastewater sector, illustrating persistent regional disparities despite substantial EU funding allocations. Their findings resonate with those of Banghiore Moise, and Stan (2024, p.101), who argue that the sustainability of sewerage services is intrinsically linked to coherent financial strategies, regulatory compliance, and cost-reflective pricing mechanisms – an interconnection often absent from sectoral reforms. This dynamic also reflects broader governance issues observed in public services, where the strategic integration of human capital and EU funding mechanisms remains inconsistent (Stan and Tasește, 2023, p.172).

Efforts to modernize water networks have been further hindered by administrative fragmentation and uneven absorption capacity for EU funds. The regionalization of services, while conceptually sound, has yielded mixed results, largely due to poor coordination among local stakeholders and a lack of robust institutional support (Banghiore *et al*, 2024, p.97; Moise *et al*,

2024a, p.120). This fragmentation exacerbates the structural imbalance between urban and rural service areas, impeding equitable access and undermining long-term service viability. Studies such as Rauhut and Humer (2020, pp.2120-2122) document spatial-economic divergences that mirror infrastructural disparities, reflecting broader inefficiencies in development policy coordination. In this regard, sustainable urban planning is increasingly acknowledged as essential for reconciling urban growth with ecological constraints, ultimately enhancing quality of life across communities (Braşoveanu, 2024, p.104).

Against this backdrop, the role of digitalization and advanced monitoring technologies has emerged as a recurrent theme in the literature. Authors such as Hangan *et al* (2022, p.2) and Ismail *et al* (2023, p.71795) emphasize the strategic value of smart metering, remote sensing systems, and artificial intelligence (AI) applications in water treatment, which support pollutant removal through non-linear modeling and improved process control. Although their deployment remains limited in Romania, largely due to capital constraints, the potential for transformative impact is clear. These findings align with international best practices in performance-based asset management, as proposed by Mazumder *et al* (2018, pp.7-11), who advocate for a shift from reactive to predictive maintenance models. The integration of digital innovation into public infrastructure management also remains closely linked to the ability to absorb and strategically allocate EU funds. In this regard, recent analyses reveal that regional disparities in absorption rates and project implementation significantly affect the efficiency and sustainability of funded interventions (Stan and Cojocaru, 2022a, pp.467-468. 2022b, p.180). Although funding mechanisms are available, insufficient institutional coordination, administrative delays, and fragmented planning reduce the transformative potential of digital solutions in sectors such as water infrastructure.

Economic sustainability remains a defining pillar in discussions on infrastructure viability. Aivaz and Avram (2021, p.476), as well as Munteanu, Ionescu-Feleagă, and Ionescu (2024, pp.3-4), underscore the financial fragility of utility operators, particularly in the absence of risk-sharing instruments and diversified funding streams. Circular economy models, explored by Smol, Adam, and Preisner (2020, p.683) and further elaborated by Munteanu *et al* (2025, pp.2-3), offer a pathway toward financial and environmental alignment, yet demand significant upfront investments and regulatory innovation. In this regard, Romania faces the dual challenge of enabling institutional flexibility while managing fiscal prudence. Improved treatment technologies contribute directly to operational sustainability, reducing pollutant loads and enhancing compliance with environmental standards.

Moise, Banghiore, and Stan (2024b, p.62) provide a nuanced statistical portrait of Romanian water operators, applying principal component analysis (PCA) to identify performance clusters and typological disparities. Their research not only confirms the operational heterogeneity of utilities but also illustrates how raw water quality, pipe materials, and energy consumption affect cost-efficiency and service reliability. These variables, while technical in nature, are closely tied to institutional capacity and strategic planning. This complexity also echoes the broader findings of Mirea and Aivaz (2016, p.203) who emphasize risk-based decision models as essential for competitiveness and long-term sustainability in utility management.

From a resilience perspective, the application of complex network theory by Alaggio *et al* (2025, pp.3-5) provides a methodological advancement in identifying critical nodes within WDNs. This analytical approach enables targeted interventions by assessing both the probability and systemic consequences of component failures. Such tools are essential for Romania's utility sector, which operates in a context of chronic underfunding and fragmented governance.

Concurrently, the literature emphasizes the necessity of integrating performance benchmarks and vulnerability assessments into investment planning. Pietrucha-Urbaniak (2015, p.138) highlights how failure data, though often underutilized, can serve as a predictive input for renewal prioritization. The absence of centralized databases in Romania significantly constrains this potential, as noted by Tchórzewska-Cieślak *et al* (2023, p.2) and Aivaz (2021b, p.18), who advocate for advanced IT systems to facilitate real-time data collection and analysis.

Institutional development and governance reforms are identified as essential to overcoming structural rigidities. Research by Batrancea *et al* (2021, p.2), Rus (2020, p.44), Stroie *et al* (2023, p.79), and Aivaz and Tofan (2022, p.3) highlights the importance of regulatory stability, capacity-building, and transparent decision-making frameworks. These factors are critical not only for

financial solvency but also for social legitimacy, especially in a sector where public trust and affordability remain contentious issues.

Finally, the literature situates Romania's water infrastructure challenges within the broader European agenda for sustainable development. Smol, Adam, and Preisner (2020, pp.687-689) emphasize that water services must transition from linear to circular models, embedding principles such as resource recovery and demand-side management.

In sum, the reviewed literature converges on a key insight: the sustainability of Romania's public water networks cannot be achieved through isolated technical upgrades or policy adjustments. Rather, it necessitates a systems-oriented approach that integrates technological innovation, financial instruments, governance reforms, and performance monitoring into a coherent and adaptive framework. The Romanian experience thus serves as both a case study in institutional transformation and a reference point for future research on sustainable infrastructure governance in transitioning economies.

3. Research methodology

The present analysis was conducted on a sample of 43 major regional operators in the public water supply sector in Romania. The aim of the approach was to identify common patterns and structural differences between these operators, based on relevant technical indicators that reflect both the size of the managed networks and the operational performance in terms of infrastructure. The analysis employed the following indicators: *number of pipeline failures*, *number of failures in transmission mains*, *number of failures in the distribution network*, and the *total length of the distribution network*, measured in kilometers.

To begin with, the data were subjected to a descriptive analysis, designed to highlight the distribution of each indicator. The results indicated a significant dispersion of the values, especially with regard to pipe and distribution network failures. These two indicators presented high levels of positive asymmetry (skewness above 2) and accentuated kurtosis, suggesting the presence of extreme values that influence the mean and internal variability of the data. Thus, before performing cluster analyses, increased attention was required in interpreting the central tendency values, given the highly unbalanced nature of the distributions.

In order to identify patterns of similarity between operators, hierarchical cluster analysis was used, with the method of average linkage (Average Linkage Between Groups), applied based on the standardized Euclidean distance. The result of this analysis was graphically represented by a dendrogram, which clearly highlighted the separation of entities into two major clusters. A first, smaller group brought together operators that presented atypical characteristics – especially extreme values of damages and, in some cases, of network size. The second group, much larger, was composed of operators whose values fell within an average range, forming a relatively homogeneous category.

To verify the robustness of the classification achieved, an ANOVA analysis was applied to the four indicators, having as group variable the membership in the cluster. Although the F tests cannot be interpreted in a strictly inferential sense, since the grouping was constructed to maximize differences, the results offer a relevant descriptive perspective. Pipeline failures and distribution network failures were the variables that most clearly differentiated the two groups, with F-statistic values above 180 and extremely low significance levels ($p < .001$). The network length also presented a significant differentiation between clusters, while the number of failures per supply did not contribute significantly to their separation.

Therefore, the adopted methodology allowed the outline of a differentiated profile of regional operators according to the performance of the managed networks, providing an objective framework for analyzing vulnerabilities and intervention needs in the public water sector in Romania. This statistical approach can constitute an important support for the formulation of public policies in the field of water infrastructure, especially with regard to prioritizing investments according to the operational typology of operators.

4. Findings

Table no. 1 provides an overview of the descriptive distribution of the four indicators used in the analysis of the 43 regional operators in the Romanian water sector: pipe failures, distribution network length, supply failures and distribution network failures. Their interpretation allows us to better understand the general characteristics of the dataset and to identify possible asymmetries or extreme values.

Table no. 1 Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic Std. Error	Statistic Std. Error
Pipeline failures (no.)	43	11	11879	2174.47	2876.403	2.489	.361
Total length of the distribution network (km)	43	380	3375	1261.95	791.722	1.217	.361
Failures in transmission mains (no.)	43	0	247	39.12	57.081	2.203	.361
Failures in the distribution network (no.)	43	11	11739	2135.35	2862.326	2.485	.361
Valid N (listwise)	43						

Source: Authors' work

With regard to *pipeline failures*, the values range between 11 and 11,879, with a mean of approximately 2,174 and a very high standard deviation (2,876), indicating a sharp dispersion of the values. The pronounced positive asymmetry (skewness = 2,489) suggests that most operators have a relatively low number of failures, but there are a few cases with extremely high values that push the mean up. The high kurtosis (5.802) indicates a leptokurtic distribution, i.e. concentrated around the mean, but with thick tails – again, a sign of extreme values.

The *length of the distribution network* varies between 380 and 3,375 km, with an average of approximately 1,262 km and a standard deviation of 792 km, which denotes a significant variability, but more moderate compared to the other indicators. The skewness of 1.217 suggests a slight positive asymmetry – that is, there are a few operators with particularly large networks – and the kurtosis of 1.290 indicates a somewhat flatter than normal distribution, but without pronounced extreme values.

In the case of *failures in transmission mains*, we observe the lowest average (39.12) and a relatively low dispersion (standard deviation of 57.08). However, the extreme values (from 0 to 247) and the skewness of 2.203 still suggest a pronounced asymmetry, i.e. most operators have few breakdowns, but a few have a significantly higher number. The kurtosis of 4.792 reinforces the idea of the presence of isolated cases, with large deviations from the average.

Failures in the distribution network follow an almost identical pattern to pipeline failures, with values between 11 and 11,739, a close mean (2,135), a high standard deviation and high values of skewness (2,485) and kurtosis (5,768). This confirms the presence of operators facing unusually high levels of failures, in a general context in which the majority have much lower values. In conclusion, the distributions of the four indicators are strongly asymmetric, especially those concerning failures. This suggests the existence of significant discrepancies between operators, probably related to the size of the network, the degree of wear of the infrastructure or the operational efficiency. Thus, the subsequent analysis must take into account these characteristics, especially the influence of extreme values, which can affect the interpretations of the mean and the overall variation.

The analysis carried out on the 43 major regional operators with public capital in Romania in the water sector aimed to identify patterns of behavior and technical performance, based on four relevant indicators: pipeline failures, failures in transmission mains, failures in the distribution

network, and the total length of the water network. As can be seen in Table no. 2, the application of the clustering method led to the identification of two distinct clusters, suggesting the existence of significant differences between operators in terms of infrastructure and frequency of technical problems.

Table no. 2 Cluster Membership

Case Number	Cluster	Distance	Case Number	Cluster	Distance
1	2	1301.510	23	1	3559.615
2	2	1099.499	24	2	778.539
3	1	4104.671	25	2	432.060
4	2	1918.571	26	2	1191.149
5	2	1131.028	27	2	1611.832
6	2	1187.045	28	2	576.172
7	2	333.500	29	2	369.680
8	2	488.297	30	2	1519.220
9	2	2602.859	31	1	4962.499
10	2	327.272	32	2	713.819
11	2	1085.416	33	2	2699.186
12	2	1541.055	34	2	1104.982
13	1	1711.602	35	2	821.085
14	1	3716.398	36	2	2590.724
15	2	1634.671	37	2	1607.979
16	2	2035.378	38	2	1119.906
17	2	956.306	39	2	1151.404
18	2	1839.043	40	2	668.609
19	2	1129.573	41	2	1108.155
20	2	805.660	42	2	1851.129
21	2	1393.921	43	2	612.900
22	2	358.838	-	-	-

Source: Authors' work

The first cluster brings together a small number of operators, only five in number, who stand out for their atypical behavior in relation to the others. The very large distances from the center of this cluster indicate that these operators face extreme values of one or more of the analyzed indicators. It is possible that they manage very extensive networks or, conversely, operate under very different technical or organizational conditions than the other entities. The frequency of failures could be unusually high, or the managed infrastructure could have particular characteristics, which places them in an area of special interest for the analysis of performance and intervention needs.

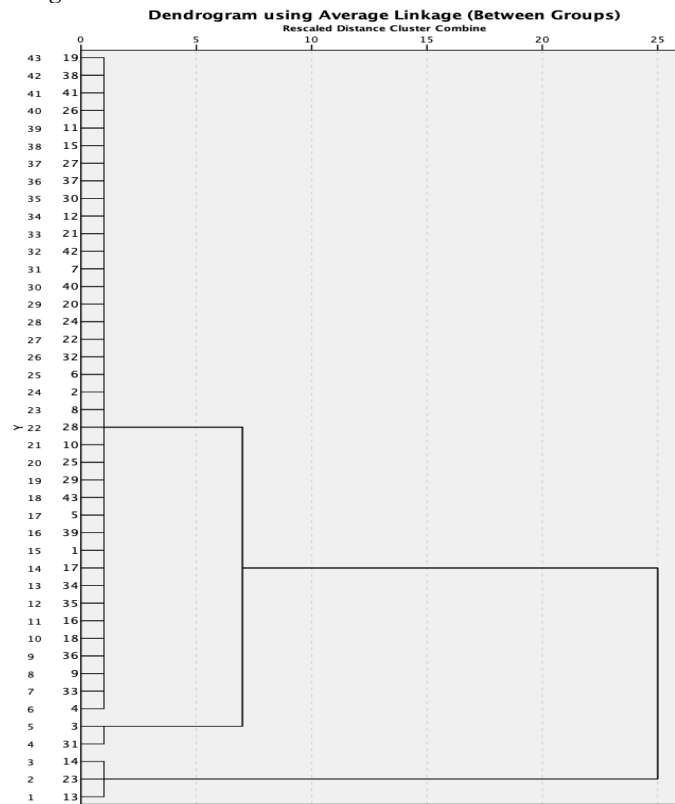
The second cluster, considerably larger, includes the majority of the operators in the sample. These operators appear to share common characteristics, with moderate variation across the analyzed indicators, suggesting a certain level of functional and structural homogeneity. This grouping may be regarded as representative of the average profile of a water operator in Romania and can serve as a reference point for evaluating overall performance within the sector.

Therefore, the result of this analysis highlights the existence of significant structural differences between operators, which may reflect not only the particularities of the network and the territory served, but also different levels of development, investment or efficiency in infrastructure management. The identification of these two distinct groups provides a useful basis for investment prioritization, the formulation of targeted intervention policies, and the promotion of performance standards adapted to on-the-ground realities.

The dendrogram in Figure no. 1, generated by the Average Linkage method, highlights how the 43 regional water operators with public capital in Romania were grouped according to their similarity based on the analyzed indicators (pipeline failures, transmission main failures, distribution network failures, and total water network length). This dendrogram indicates that there are two main groups of operators. The first group is very compact and homogeneous, including the vast majority of cases, which are linked to each other at very small distances on the similarity scale.

This close clustering suggests that most operators are significantly similar to each other from the perspective of the analyzed technical characteristics. They most likely have a common technical and operational profile, in terms of the number of failures and the length of the network managed.

Figure no. 1. Dendrogram



Source: Authors' work

In contrast, in the lower part of the dendrogram, a small group of operators can be observed that clearly stands out from the rest, joining the rest of the structures at a much greater distance. Cases 13, 23, 14, 3 and 4 are those that appear in this isolated area. These entities can be considered atypical from the point of view of the indicator values, and their differentiation at a low level of similarity indicates that they exhibit extreme or significantly different features. These could be operators with particularly large or small networks, or with a frequency of failures considerably different from the average.

Thus, the dendrogram confirms the existence of two clear patterns of operation within the analyzed operators: a homogeneous, majority mass, and a restricted group with a distinct profile. This structure supports the idea of the existence of a dual typology in the public water sector in Romania, with important implications for investment policy and prioritization of interventions.

The results of the ANOVA analysis (Table no. 3) applied in the context of the classification of the 43 regional operators in the Romanian water sector provide relevant information about the differences between clusters in terms of the analyzed indicators. Although the F-tests cannot be considered rigorous from an inferential point of view – since the clustering was constructed precisely to maximize the differences between groups – they are useful for describing the consistency of the differences observed between clusters.

The most pronounced differences between the two clusters occur in the case of distribution network failures and pipeline failures. The extremely high F-values for these two indicators (183.35, 184.37, respectively) and the very low statistical significance level ($p < .001$) suggest that these variables contribute most to the differentiation between the two groups of operators. In other words, the frequency of distribution network and pipeline failures are essential factors in shaping the distinct profile of each cluster, probably reflecting different levels of wear, maintenance or

modernization of the water infrastructure.

The length of the distribution network also makes a significant contribution to the differentiation of the clusters, with an F-score of 33.71 and a p-value still below the significance threshold (.001). This indicates that the size of the operated infrastructure also plays an important role in shaping the operational profiles, suggesting that operators with larger networks may have distinct characteristics in terms of technical issues and how they are managed. Conversely, the indicator related to failures in transmission mains does not significantly contribute to the differentiation between clusters ($F = 1.71$, $p = 0.199$). This result shows that, regardless of the group they belong to, the operators present relatively close values in terms of the number of failures in this component of the network, which suggests a uniformity or reduced variability between regions for this specific indicator.

Table no. 3 ANOVA Analysis

	Cluster		Error		F	Sig.
	Mean Square	df	Mean Square	df		
Pipeline failures (no.)	283989360.529	1	1548924.589	41	183.346	<.001
Total length of the distribution network (km)	11880172.559	1	352351.144	41	33.717	<.001
Failures in transmission mains (no.)	5466.645	1	3204.336	41	1.706	.199
Failures in the distribution network (no.)	281502864.899	1	1526815.436	41	184.373	<.001

The F tests should be used only for descriptive purposes because the clusters have been chosen to maximize the differences among cases in different clusters. The observed significance levels are not corrected for this and thus cannot be interpreted as tests of the hypothesis that the cluster means are equal.

Source: Authors' work

To conclude, the results clearly confirm that the differences between clusters are primarily supported by the recorded values for pipeline failures, distribution network failures, and the length of the operated network, while failures in transmission mains appear to have a limited influence on the grouping of operators into distinct clusters. These findings may prove valuable for developing differentiated intervention and support strategies for regional operators, based on the structural vulnerabilities identified.

5. Conclusions

The analysis of Romania's public water distribution networks confirms the existence of structural disparities among regional operators, reflected in significantly different rates of technical failures and network dimensions. The identification of two distinct clusters of operators indicates that the sector does not operate uniformly, and therefore, infrastructure policies must be differentiated and evidence-based. A small number of operators face very high failure frequencies and manage extensive or atypical networks, while the majority present more moderate values and relatively stable performance profiles.

These findings suggest that water infrastructure performance in Romania is influenced not only by technical factors but also by institutional capacity and resource allocation. High failure rates in some networks are likely the result of both physical degradation and insufficient planning or maintenance. The variability of the analyzed indicators, especially the strong asymmetry in failure-related data, highlights the need for prioritization in investment strategies, focusing on those operators most affected by operational inefficiencies.

The results also show that indicators such as pipeline and distribution failures, as well as network length, are useful for classifying operator performance and can support the formulation of targeted interventions. By contrast, failures in transmission mains showed lower differentiation capacity, suggesting more homogeneous performance in this area. The analytical method used

provides a functional basis for comparing operators and supports the development of differentiated technical and financial responses at regional level.

Improving network sustainability will require better integration of performance data into infrastructure planning. This includes systematic use of statistical tools to monitor trends, identify risk patterns, and align rehabilitation programs with objective technical criteria. In addition, the implementation of preventive maintenance systems and digital monitoring technologies can reduce losses and extend the service life of infrastructure.

In conclusion, the sustainability of public water networks in Romania depends on the capacity to address technical imbalances, allocate investments based on performance evidence, and support institutional development. A uniform policy approach is insufficient in the face of operational diversity across regions. Future strategies should promote clearer performance benchmarks, prioritize support for underperforming operators, and encourage the use of operational data in infrastructure management. These steps are necessary to ensure the reliability, efficiency, and long-term viability of the public water sector.

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Beyond the Rainbow: Aligning Hydrogen Color Codes with CO₂ Emissions for a Transparent Energy Transition

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Abstract

Hydrogen is promoted as an essential building block in the energy transition, yet color codes used to describe its production pathways lack consistency. Color labels (e.g., green, blue, grey, black) are adopted in policy and industry discourse but fail to reflect carbon dioxide emissions. This article examines color classifications, building on an existing framework by expanding it through a qualitative assessment of recent literature. It analyzes how various production technologies - including water electrolysis powered by renewables, steam methane reforming, coal gasification, and nuclear-based processes - are labeled. Findings reveal significant inconsistencies, particularly for fossil-based and nuclear hydrogen, and highlight that renewable-based hydrogen is uniformly classified as green regardless of production specifics. The analysis suggests that if color codes were reassigned based on actual emissions, fossil-derived hydrogen would fall into a narrower, darker spectrum. These results call into question the compatibility of non-green hydrogen with climate objectives of the Paris Agreement.

Key words: green hydrogen, color code, carbon dioxide emissions, Paris Agreement

J.E.L. classification: M10

1. Introduction

This article revisits how hydrogen production methods are classified by color and proposes a restructured system that reflects carbon dioxide (CO₂) emissions rather than solely the technology or fuel used. The present work substantially builds upon the conference paper originally presented at the 17th International Conference on Business Excellence (Ocenic *et al*, 2023, p.111).

The primary aim is to develop a new color code for hydrogen that is grounded in scientific data regarding emissions associated with each production pathway—such as electrolysis using renewable or nuclear energy, steam methane reforming, or coal gasification, etc. This shift from technology-based to emission-based classification seeks to clarify industry practices, align with decarbonization goals, and enhance transparency for researchers, industry stakeholders, and policymakers. In doing so, the paper contributes to the broader dialogue on transitioning toward a sustainable hydrogen economy. Given the growing emphasis on “green” hydrogen in international climate policy contexts like the Paris Agreement, it becomes increasingly urgent to standardize terminology and promote a shared understanding of hydrogen production routes (Raman *et al*, 2022, p.9242).

The benefits of a unified color code extend beyond academic clarity. Color labels simplify communication around complex technological pathways, provide intuitive insights into carbon intensity—such as “green” indicating minimal emissions and “black” indicating high emissions—and assist in visually mapping relationships across different methods. This article adopts a qualitative comparative approach to assess whether there is currently a shared and consistent hydrogen classification framework in place. It tests two competing hypotheses: that such a harmonized color code does or does not exist in present literature and practice. Drawing on the foundational study by Nikolaidis and Poullikkas (Nikolaidis *et al*, 2017, p.609), this paper builds a critical assessment of hydrogen color coding through a literature-based comparison and graphical representation of classification inconsistencies.

Understanding and standardizing hydrogen classification holds relevance for business administration as well. A common taxonomy improves coordination within the hydrogen value chain, encourages consistency in marketing and regulatory compliance, and aids managers and investors in selecting sustainable production methods. Ultimately, this article illustrates that the current symbolic system of color codes is often misaligned, unregulated, and at times contradictory – calling into question whether hydrogen labels like “blue” or “grey” accurately reflect carbon performance. By identifying these gaps, this research lays the groundwork for a more rigorous and harmonized emissions-based framework that supports the development of sustainable and transparent hydrogen markets.

2. Theoretical background

2.1 Literature review

Hydrogen production has gained a global character, especially evident in the number and geographic distribution of planned projects (Ocenic, 2023a, p.477; Ocenic, 2024, p.1201). The classification of hydrogen by color has become convenient when discussing the carbon intensity of various production pathways. However, a growing body of literature reveals inconsistencies in terminology, lack of standardization, and regional discrepancies in the use of labels such as “green,” “blue,” “grey,” and beyond (Ocenic, 2023b, p.460). This chapter surveys recent academic and institutional contributions to hydrogen color coding, with an emphasis on how these systems influence technological adoption, market structures, and investment decisions. Special attention is given to how the color code debate intersects with carbon accounting practices, certification mechanisms, and regulatory uncertainty in both EU and global contexts.

- Hydrogen production pathways

At present, 98% of global hydrogen is produced using fossil fuels (IRENA, 2022, p.7). Nonetheless, hydrogen generated through water electrolysis coupled with renewable energy sources – like hydropower, wind, or solar – is increasingly recognized as a crucial vector for enabling the low-carbon transition. This “green” hydrogen is particularly relevant for decarbonizing sectors that are traditionally difficult to electrify, including the iron and steel industry and aviation (IRENA, 2020a, p.4; Howarth *et al*, 2021, p.1677).

The academic literature provides various assessments of hydrogen production routes, among which the work of Nikolaidis and Poullikkas stands out for its comparative scope (Nikolaidis *et al*, 2017, p.597). Their study presents a structured overview of production methods that use both fossil-based feedstocks (oil, coal, natural gas) and renewable energy inputs (wind, solar, bioenergy), complemented by a visual mapping of the technological options.

However, despite its value, this overview shows notable omissions in light of current advancements. First, it does not include nuclear energy pathways, even though these fall within the author’s stated scope. Second, the representation lacks emerging technologies such as hydrogen produced via microwave plasma reforming, a method recently gaining traction in academic discussions (Pocha *et al*, 2023, p.1). Third, although the term “green hydrogen” is used, the article does not clearly define the criteria for this classification, creating ambiguity in interpretation.

- Hydrogen colors: a spectrum without consensus

Although hydrogen is an invisible and colorless gas, the industry and academia have adopted a diverse color-coded system to denote its production methods—an irony often remarked upon by sector professionals (Giard, 2022). These labels span a wide spectrum, including white, green, grey, blue, black, brown, turquoise, yellow, orange, pink, red, and purple.

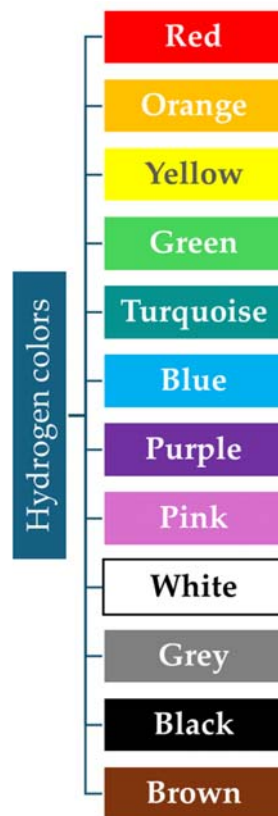
Despite the widespread use of these labels, there remains no consensus on what each color represents. The lack of standardization is evident across industry stakeholders, government policy, and academic publications. For example, institutions like the International Energy Agency (IEA) and the Hydrogen Council tend to avoid color-based classifications altogether (IEA, 2021, p.6), whereas the International Renewable Energy Agency recognizes specific colors such as green, grey, blue (IRENA, 2021, p.7), and sometime turquoise (IRENA, 2020b, p.8).

In the academic domain, Ringsgwandl et al. (Ringsgwandl *et al*, 2022, p.1) define "green" hydrogen as that produced via electrolysis using electricity exclusively sourced from renewables. Their framework also assigns other colors to additional pathways: "pink" for hydrogen produced using nuclear power and "yellow" for hydrogen generated from a mixed electricity grid (including both renewable and fossil sources).

However, this scheme presents several limitations. Firstly, it excludes several commonly cited colors, such as "brown" (Howarth *et al*, 2021, p.1677) and "black" (Osselin *et al*, 2022), which typically refer to hydrogen derived from coal or oil, thus offering only a partial taxonomy. Secondly, there are inconsistencies in how colors are used across sources. For instance, some scholars use "pink" to denote nuclear-sourced hydrogen and "yellow" for electrolysis with electricity from the grid which can be any source (Ringsgwandl *et al*, 2022, p.3), other studies define "pink" similarly (Ajanovic *et al*, 2022, p.24143) but describe "yellow" hydrogen as derived specifically from solar power (Acciona, 2022).

Figure no. 1 contains the colors identified by the author being currently used in the literature in connection to hydrogen produced via different technologies from different sources.

Figure no. 1. Hydrogen color codes used by researchers, businesses and institutions



Source: Author's own research results

2.2 Socio-technical transitions theory

Multi-level perspective (MLP) theory frames socio-technical transitions as evolving processes shaped by multiple interacting levels along three analytical layers: the landscape (macro), regime (meso), and niche (micro), whereby niche refers to innovations or "radical novelties" (Geels, 2004, p.910). In the context of hydrogen classification, the "landscape" includes macro-drivers such as the Paris Agreement (United Nations, 2015) at international level, the European Green Deal (European Commission, 2019) within the European Union, and – more generally – global decarbonization targets. These forces pressure existing "regimes," which include regulatory frameworks, incumbent

energy and industry actors, and industrial norms that rely on legacy classification schemes.

At the "niche" level, emerging frameworks like a proposed carbon-dioxide-based hydrogen color code challenge the regime by offering a more transparent, simple, yet evidence-based approach aligned with emissions accounting and climate goals. The introduction of such classification systems can disrupt current market logic and enable new forms of energy governance, supporting the diffusion of low-carbon technologies and consumer trust.

By reframing hydrogen technologies and related colors as a socio-technical innovation, we expose how symbolic tools (like color codes) shape market incentives, business behavior, influence technological choices, and impact policy design. The transition toward a carbon-dioxide-based color code thus represents more than a semantic shift—it reflects a broader systemic reconfiguration.

Generative artificial intelligence was used to rephrase some ideas that were initially published in the conference paper that was presented at the 17th International Conference on Business Excellence (Ocenic *et al*, 2023).

3. Research methodology

To investigate the inconsistency of hydrogen color labels and propose a harmonized alternative, this paper adopts a qualitative, interpretive methodology grounded in comparative document analysis. Drawing from academic literature, institutional reports, and policy documents, it maps the range of hydrogen production technologies and associated color labels. This is followed by a simplified classification framework. It also incorporates visual analysis tools to illustrate inconsistencies in current classifications, and it proposes a new, carbon dioxide emissions (CO₂) based typology for future use.

This paper extends the foundational work of Nikolaidis and Poullikkas (Nikolaidis *et al*, 2017) by expanding the comparative review with the most recent academic and institutional literature and examining whether a shared understanding exists regarding which production methods correspond to which color labels in the hydrogen lexicon.

3.1 Dominant research question

The dominant research question guiding the present analysis is:

Is there a widely accepted and harmonized color code that accurately and consistently maps hydrogen production technologies to specific colors?

Two hypotheses are tested:

H₁: A standardized, commonly accepted color code exists across literature, institutions and industry.

H₂: No such harmonized system exists, and color usage varies significantly across sources.

3.2 Methodological approach

To address this question, the research follows a four-stage methodological approach:

- Literature review

A comprehensive review of peer-reviewed publications, technical reports, and position papers from international organizations involved in hydrogen strategy and policymaking is conducted. The goal is to map existing knowledge on hydrogen production methods and their corresponding color labels.

- Comparative analysis

The second phase involves a systematic comparison of the visual and textual depictions of hydrogen production pathways found in the literature. This includes classifying technologies based on both the feedstock (e.g., natural gas, coal) and conversion process (e.g., electrolysis, gasification, reforming). Where color codes are present, these are documented and compared across sources.

- Graphical redesign and enrichment

Building on the initial framework proposed by Nikolaidis and Poullikkas (Nikolaidis *et al*, 2017), the paper constructs a new and enriched graphical representation of hydrogen production methods.

This updated diagram incorporates additional technologies sourced from recent literature (Akubo *et al*, 2019; Osselin *et al*, 2022; Pocha *et al.*, 2023; Okeke *et al*, no date).

- Colour mapping and visual coding

In the final step, each hydrogen production pathway is assigned one or more colors based on the findings from the literature review. In cases where a technology is labelled with multiple colors in different sources, the visual illustration reflects these variations using a gradient color indicator to represent the inconsistencies.

Following this process, this article offers a more holistic and structured view of hydrogen production technologies and their symbolic color representations. If all sources converge on the same color for a given technological pathway, the first hypothesis is supported. If multiple colors are assigned to a single technology – or if the same color refers to different methods – the findings validate the second hypothesis, suggesting a lack of consistency in the current system.

Ultimately, this research seeks to evaluate whether the color code system reflects a coherent, widely accepted classification scheme, and to propose a refined version based on carbon dioxide emissions from each production pathway.

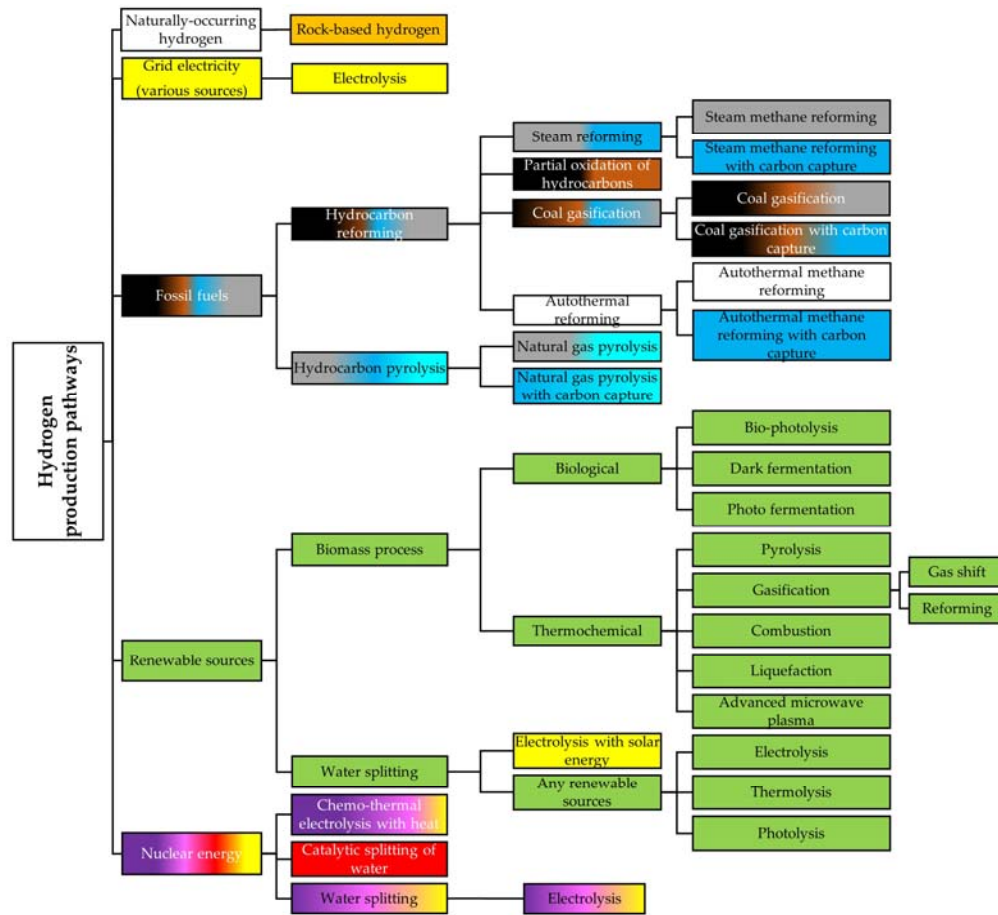
4. Findings

4.1 Comparative analysis of hydrogen color schemes

This section presents a comparative overview of hydrogen color classification schemes (Ocenic *et al*, 2023, p.117) used by governments, international organizations, industry actors, and researchers, as presented in Figure no. 2. The analysis reveals major discrepancies in how similar production technologies are labeled across jurisdictions. Focus is put on the inconsistencies in color coding for fossil-based hydrogen, hydrogen produced using nuclear energy, and electrolysis with electricity from the grid which can come from various energy sources. Through this comparison, this article highlights the risks posed by inconsistent labeling, including consumer confusion, regulatory loopholes, and distorted investment signals.

Each production pathway in this visual is assigned one or more colors based on how it is labeled across various sources. In cases where a specific technology is associated with multiple colors in the literature, these discrepancies are depicted using gradients that reflect the full range of identified color codes—whether two, three, or more variations.

Figure no. 2. Colors representing different hydrogen production pathways



Source: (Ocenic et al, 2023, p.117)

4.2 Inconsistencies in color labelling hydrogen production pathways

As evidenced in Figure no. 2, the application of this methodology highlights substantial inconsistencies in how hydrogen colors are attributed to different production technologies, particularly those involving fossil fuels. Nuclear-powered hydrogen production also displays notable variation in color labeling across sources.

At first glance, it may appear that a logical and structured color system is in place: for example, “green” hydrogen refers to production via renewable electricity, “black” is linked to fossil fuel-based pathways, and “pink” typically denotes nuclear-powered electrolysis. While such labeling conventions may appear internally consistent within individual papers or frameworks, this comparative analysis reveals a lack of alignment across the broader literature. This results in overlapping and, at times, contradictory classifications.

A closer examination reveals that even where partial consensus exists—such as in the case of “pink” hydrogen referring to electrolysis powered by nuclear energy—additional labels like “red,” “purple,” or “yellow” are also used for the same technology in other sources. These contradictions are problematic. For instance, Ringsgwandl et al. associate “yellow” hydrogen with electrolysis powered by a grid electricity mix, encompassing both fossil and renewable inputs (Ringsgwandl et al, 2022, p.3). However, some industrial actors (Acciona, 2022) define “yellow” hydrogen as a solar-powered subcategory of “green” hydrogen.

Further complicating matters, the definition of "green" hydrogen has evolved over time. Originally used exclusively for hydrogen produced via electrolysis with renewable electricity, the term is now often applied to any hydrogen generated from renewable sources – including biomass-based methods. The only recurring deviation from this broader definition is the labeling of solar-powered hydrogen as "yellow" by specific industry actors, as mentioned previously.

From a policy perspective, there is likewise no universal taxonomy. For example, the European Commission's Hydrogen Strategy for a Climate-Neutral Europe avoids using color classifications altogether. Instead, it defines "renewable hydrogen" as hydrogen "produced through the electrolysis of water (in an electrolyser, powered by electricity), and with the electricity stemming from renewable sources" (European Commission, 2020, p.3), with negligible greenhouse gas emissions. The strategy also extends the definition to include hydrogen obtained by "reforming of biogas (instead of natural gas) or biochemical conversion of biomass" (European Commission, 2020, p.4), provided these methods meet established sustainability criteria.

Even greater ambiguity arises in the classification of hydrogen derived from fossil fuels. Terms such as "black," "grey," and "brown" are often used interchangeably depending on the source, without clear criteria. For example, hydrogen produced via pyrolysis of hydrocarbons is sometimes categorized as "grey," similar to conventional gas-based hydrogen, while other sources refer to it as "turquoise," often without a clearly articulated rationale.

One notable point of convergence across sources is the use of the term "blue" hydrogen to describe fossil-based hydrogen production coupled with carbon capture and storage (CCS) technologies. That appears to be the only category where some degree of consensus has emerged.

In the case of naturally occurring hydrogen, often referred to as geologic or subterranean hydrogen, researchers have informally labeled it as "white" hydrogen—even though hydrogen itself is inherently colorless. This categorization underscores the symbolic nature of the color system. Interestingly, the passive extraction of naturally present hydrogen has been proposed as a substitute for established production methods, which use active chemical or electrochemical processes. One such approach involves injecting water into subsurface ferrous rock formations to release hydrogen – a method known as "orange" hydrogen, named for its association with the oxidation process that produces rust-colored iron deposits (Osselin *et al*, 2022, p.765).

A significant limitation of the current hydrogen color taxonomy is that it does not comprehensively cover all existing or emerging production technologies. As new methods are developed, the absence of a theoretical, empirical, or even intuitive framework for assigning colors raises concerns about the sustainability of the color-based classification system itself. There is a real risk of "running out" of distinct and meaningful colors to represent future innovations.

For instance, hydrogen produced via autothermal methane reforming currently lacks a widely accepted color label. Although it might be considered within the broader category of fossil fuel-derived hydrogen – and thus theoretically fall under labels such as grey, brown, or black – there is no clear consensus in the literature.

Furthermore, when attempting to visually represent carbon dioxide emissions using a color-coded system – anchored in the widely held assumption that "green" signifies negligible emissions while "black" indicates high emissions—hydrogen derived from fossil fuels tends to cluster toward the higher-emission end of the spectrum. This reduces the practical differentiation among fossil-based methods despite their varied technical characteristics. As illustrated in Figure no. 2, this convergence suggests that the current color palette overstates the diversity of fossil-based hydrogen pathways while underrepresenting the need for an emissions-based reclassification framework.

Instead of relying on the current classification of fossil-based hydrogen as "blue," a more accurate representation—based on actual carbon dioxide emissions—would categorize hydrogen produced from coal, oil, or natural gas into varying shades of "black." A CO₂-based emissions scale would reveal that the climate impact of these production methods is often greater than what existing color codes imply.

Given that the global hydrogen debate is driven largely by the urgent need to decarbonize multiple sectors of the economy in line with international climate targets, this insight has critical implications for scientific, policy, and industrial discourses. This paper questions whether any hydrogen variant other than "green" – defined here as hydrogen obtained with renewable energy sources like wind, solar, hydropower, or bioenergy – can truly align with the emissions reduction objectives outlined in

the Paris Agreement (United Nations, 2015, p.4).

Considering the inconsistencies and lack of systematic rationale in the current hydrogen color scheme, this paper advocates abandoning the existing color taxonomy altogether. The current palette includes an incoherent mix of primary (red, yellow, blue), secondary (green, orange, purple), and tertiary colors (turquoise, brown), alongside tints like pink or achromatic colors like grey, black, and white – all of which are applied arbitrarily, without reference to any recognized color theory (Munsell, 1905).

Figure no. 3. New three-color-coded labeling proposed (green, gray, black) for hydrogen production technologies, reflecting carbon dioxide emissions



Source: Adapted from (Ocenic *et al*, 2023, p.118)

As an alternative, this article proposes adopting a simplified and standardized three-color system: green, grey, and black, as shown in Figure no. 3. This scheme would be directly tied to the carbon dioxide emissions intensity of hydrogen production methods, expressed in terms of tons of carbon dioxide emitted per kilogram of hydrogen obtained. The classification is technology-neutral and does not require special treatment for processes that incorporate carbon capture technologies—their benefits would naturally be reflected through lower emissions values.

Drawing on the Munsell color model (Munsell, 1905), the three-color scale would range from black (highest emissions), through grey (intermediate emissions), to green (lowest or near-zero emissions). This visual framework would allow for more intuitive and scientifically grounded comparisons between hydrogen production technologies, thereby enhancing public understanding and supporting the strategic planning necessary for the global transition from a global economy powered by fossil fuels to a carbon-neutral one. It would also create a more logical point of comparison for hydrogen produced using nuclear energy, which currently occupies an ambiguous place in the color taxonomy.

In this model, green hydrogen would be reserved for technologies using renewable energy with minimal emissions; black hydrogen would apply to high-emission fossil-fuel-based methods; and grey hydrogen would cover transitional pathways—such as fossil-based hydrogen with carbon capture and storage. The precise emissions thresholds that define these categories remain a subject for future empirical research.

The adoption of a harmonized, CO₂-based color code has far-reaching implications for both policymakers and market actors. For regulators, such a system could strengthen alignment with carbon pricing mechanisms, investment taxonomy regulations, and hydrogen certification initiatives like the EU Hydrogen Bank (European Commission, no date). For businesses, it offers a tool to reduce reputational and compliance risks while enabling more informed investment decisions.

5. Conclusions

This research paper presents three key findings.

First, contrary to initial appearances, there is no unified, harmonized, or widely accepted color code for categorizing the diverse technological pathways used to produce hydrogen, therefore the first hypothesis is rejected and the second one is accepted. While there is general agreement that “green” hydrogen means hydrogen obtained thanks to renewable energy sources via various methods, the classification of hydrogen derived from fossil fuels and nuclear energy remains inconsistent and often contradictory. The multitude of color labels applied by both academia and industry contributes to considerable confusion in understanding hydrogen production technologies.

Second, the paper discusses an enhanced and more inclusive graphical representation of hydrogen production pathways, developed through a comparative analysis of the most recent scientific literature. This new visual framework not only captures a broader range of production technologies

but also maps out the inconsistent application of color labels found across academic sources and industry communications. As such, it offers a more comprehensive review of the current landscape of technologies for the production of hydrogen and its labels.

Third, it challenges the validity and usefulness of the existing complex color codes, arguing that they are overly complicated, inconsistent, and lacking any systematic scientific rationale. In response, the paper proposes a simplified three-color system – green, grey, and black – grounded in the amount of carbon dioxide emitted during hydrogen production. This classification draws inspiration from Munsell's color theory and prioritizes transparency, coherence, and practical relevance over symbolic ambiguity.

The contribution of this article lies in its critique of the prevailing classification systems and its proposal for a streamlined alternative that better reflects the environmental footprint of technological pathways to produce hydrogen. By introducing a CO₂-based model, this research supports the harmonization of terminology and decision-making across policy, industry, and academia.

From a theoretical perspective, the study advances the understanding of hydrogen production classifications by synthesizing and analyzing diverse literature sources and presenting an updated visual framework. This serves as a valuable resource for researchers, policymakers, and stakeholders seeking clarity in an increasingly complex and fragmented field.

From a managerial standpoint, the proposed three-color code offers a user-friendly tool to inform investment decisions and guide strategic planning. By directly linking hydrogen classification to carbon intensity, this model enables business leaders, investors, and public officials to assess technologies based on environmental performance and align actions with decarbonization objectives.

Nonetheless, this study has certain limitations. Notably, it does not provide specific CO₂ emission thresholds for each color category within the proposed framework. Additionally, the findings are based solely on a literature review and have not yet been validated through empirical research. Future work could involve expert consultation, such as a targeted questionnaire, to test the robustness of the proposed framework and gather practical feedback on its utility in real-world decision-making.

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Development of a Retrieval-Augmented Generation (RAG) Chatbot

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Abstract

Our research presents a Retrieval-Augmented Generation (RAG) chatbot designed for intelligent document-based question answering. Built with Streamlit as the front-end, the application integrates LLaMA2 models hosted on Replicate, alongside a document retrieval system based on FAISS and SentenceTransformers. Users can upload PDF documents, which are parsed using PyMuPDF and embedded via the all-MiniLM-L6-v2 model. These embeddings are indexed in FAISS to enable efficient similarity search. Upon receiving a query, the chatbot retrieves the most relevant document excerpts based on vector similarity, constructs a context-aware prompt and forwards it to the selected LLaMA2 model for response generation. The system supports real-time interaction with dynamic parameter control and persistent conversation history using Streamlit's session state. This architecture enables the chatbot to ground responses in user-provided content (like ice skating), making it suitable for domain-specific and knowledge-intensive tasks. The modular design ensures extensibility and adaptability for diverse RAG applications.

Key words: RAG application, specialized chatbot, information retrieval

J.E.L. classification: C88, L86

1. Introduction

This paper presents a Retrieval-Augmented Generation (RAG) chatbot application designed to enhance question-answering capabilities by combining Large Language Models (LLMs) with domain-specific knowledge retrieval. Built using Streamlit as the front-end interface, the system integrates LLaMA2 models hosted on Replicate for language generation and leverages a document retrieval pipeline based on FAISS and SentenceTransformers. The primary motivation behind this work is to address the limitations of static pretrained LLMs, which often lack access to up-to-date or specialized information. By enabling the model to dynamically retrieve and incorporate content from user-uploaded PDF documents, the proposed application supports more accurate and context-aware responses.

The objective of this research is to develop an extensible, RAG chatbot framework that allows users to interact conversationally with their own knowledge base. The application is suitable for handling knowledge-intensive tasks where consistency and contextual precision are important. Through real-time document embedding, similarity-based retrieval and prompt construction, the chatbot generates high-quality answers tailored to user queries, making it ideal for use cases in education, technical support, hobbies or personalized document analysis.

The paper is structured as follows: Section 2 introduces a brief literature review; Section 3 details the system architecture and components, including the front-end interface, embedding engine, vector store and integration with LLaMA2 via the Replicate API, the document processing and retrieval workflow, while Section 4 explains the response generation mechanism and interaction design, focusing on the results and presenting use cases (Ice Skating data file from ISU Cup of China 2024 competition). It discusses the chatbot's capabilities in knowledge grounding. Finally, Section 6 concludes the research and outlines directions for future enhancements.

2. Literature review

Retrieval-Augmented Generation (RAG) is an application architecture that enhances the capability of Large Language Models (LLMs) by allowing them to access and incorporate external, often domain-specific or dynamically updated information in real-time. Instead of relying on a LLM's static pretrained knowledge without specific information, which may become outdated or insufficient in specific contexts, RAG retrieves the most relevant pieces of information from a curated knowledge base and feeds them into the generative model (Triwicaksana S and Oktavia, 2023), (Lewis *et al.*, 2020). The LLM generate text to create sentences in order to convey the results.

A RAG application relies on a two-stage process: (1) the first is the retrieval phase, where a user's input query is semantically understood and matched against a corpus of documents. This is done by converting both the user query and the documents into vector representations using a transformer-based embedding model (Ahn *et al.*, 2022). These vectors are stored in and queried from a vector database or similarity search engine such as FAISS, Pinecone, Weaviate or Qdrant. The system retrieves the most relevant document chunks based on similarity metrics like cosine or L2 distance; (2) once relevant documents are retrieved, the second stage, the generation phase, begins. The retrieved content is formatted into a prompt that includes the user's original query along with the contextual information from the documents. This prompt is passed to a generative LLM, such as LLaMA2, GPT-4 or Mistral, which produces a response that integrates both the real-world facts from the retrieved content and the model's own language fluency (Masliukhin, 2023).

RAG applications are suited to tasks that demand: (a) factual accuracy, (b) explainability or (c) reference to external knowledge. For example, in business, a RAG-powered chatbot serves as an intelligent assistant that searches through internal documentation, manuals or policies to assist employees answer questions more rapidly. Furthermore, it may assist lawyers by interpreting contracts, regulations or court rulings. In education, students may ask questions based on lecture slides (courses and other teaching materials), research papers or books, while the chatbot provides answers based on the actual content from those sources (Joan Figuerola Hurtado, 2023), (Pichai, 2023), (Parvez *et al.*, 2021).

Moreover, in healthcare, RAG applications are used to query medical guidelines, patient reports or drug databases to help in diagnosis or patient communication (Ge *et al.*, 2024), (Wang *et al.*, 2024). In customer support, a chatbot powered by RAG can automatically extract answers from FAQs, product documentation or ticket history, ensuring accurate responses. In finance, analysts/users may ask questions related to regulatory filings, earnings reports or market trends and receive answers based on relevant documents (Shao *et al.*, 2023).

The architecture of RAG applications allow us to build dedicated or specialized chatbots and they includes: (a) a user interface that captures input (prompt) and displays results; (b) a preprocessing layer that ingests and cleans raw documents (such as PDFs, books or text files); (c) an embedding engine that converts documents and queries into high-dimensional vectors; (d) a similarity search component that finds the most relevant document segments; (e) a prompt template builder that prepares the input for the LLM; (f) and the LLM itself which synthesizes a response (Jiang *et al.*, 2023), (Siriwardhana *et al.*, 2023). Moreover, RAG applications are enhanced with memory that preserves conversation history. They can be integrated with real-time data sources like APIs, databases or web scrapers to provide updated answers. RAG is rapidly evolving to support not just text, but also multi-modal inputs such as images/pictures/graphics, tables/numerical values and video, which allows users to ask questions and get interpretation about content in various formats. Thus, RAG app may become the foundation for next-generation AI assistants that are more knowledgeable and personalized (Rackauckas, 2024).

3. Research methodology

The proposed application is a *Retrieval-Augmented Generation (RAG) chatbot* built using *Streamlit* as the front-end, *LLaMA2* models hosted on *Replicate* for language generation and a document retrieval system based on *FAISS* and *SentenceTransformers*. The chatbot is designed to answer user queries intelligently by pulling relevant information from uploaded text PDF

documents. The user interface is built entirely with Streamlit (in Python using Visual Studio Code). On the left sidebar, the user is prompted to provide a Replicate API token and can choose between two LLaMA2 models: the 7B or 13B variant.

The main difference between LLaMA2-7B and LLaMA2-13B lies in the number of parameters they contain, around 7 billion and 13 billion, respectively (Table 1). This difference significantly impacts their performance and computational requirements. Generally, the 13B model delivers better results in tasks requiring deeper reasoning, more accurate text generation and longer context retention. However, this comes at the cost of increased memory usage and slower inference times.

The 7B model is lighter and faster, making it more suitable for real-time applications, lower-end hardware, or edge deployment. It can typically run on a single high-end GPU with 24 to 32 GB of VRAM, while the 13B model usually requires multiple GPUs or a server-grade setup with at least 48 GB of VRAM to operate efficiently. While both models are capable, the choice between them depends on our specific use case. If we are building a chatbot or an assistant where speed and efficiency matter more than ultra-precise answers, the 7B model is a good choice. On the other hand, if our goal is to achieve more nuanced outputs, handle complex instructions, or fine-tune for demanding tasks, the 13B model is a better fit.

The interface also offers sliders to configure generation parameters like temperature, top-p and the maximum response length. There is an optional file uploader for submitting one or more PDFs and a button to clear the chat history. The main view shows a chat-style interaction, where messages from the user and assistant appear as chat input bubbles.

When the user uploads PDF files, the application uses *PyMuPDF* (via the *fitz* library) to extract textual content from the documents. This text is then passed through the *all-MiniLM-L6-v2* model from the sentence-transformers package to generate vector embeddings. These embeddings are stored in a *FAISS flat L2 index*, enabling efficient similarity search. The original text is kept in memory alongside the vector index to allow later retrieval.

Once documents have been uploaded and indexed, the chatbot becomes knowledge-aware. When the user sends a message in the chat, that query is embedded using the same MiniLM model, and a vector similarity search is performed using FAISS (as in Figure 1). The top-k most relevant chunks of text are selected, filtered based on a distance threshold, and concatenated to form a contextual background. This retrieved context is then prepended to the user's original query using a fixed prompt format that instructs the LLM to "use the following relevant information" to answer the question.

The final prompt, which includes both the context and the user's question, is then sent to the selected *LLaMA2* model via Replicate's API. The response is streamed back and displayed in the chat interface. This entire process is repeated for each user input, ensuring the chatbot always responds using the most relevant content from the uploaded documents.

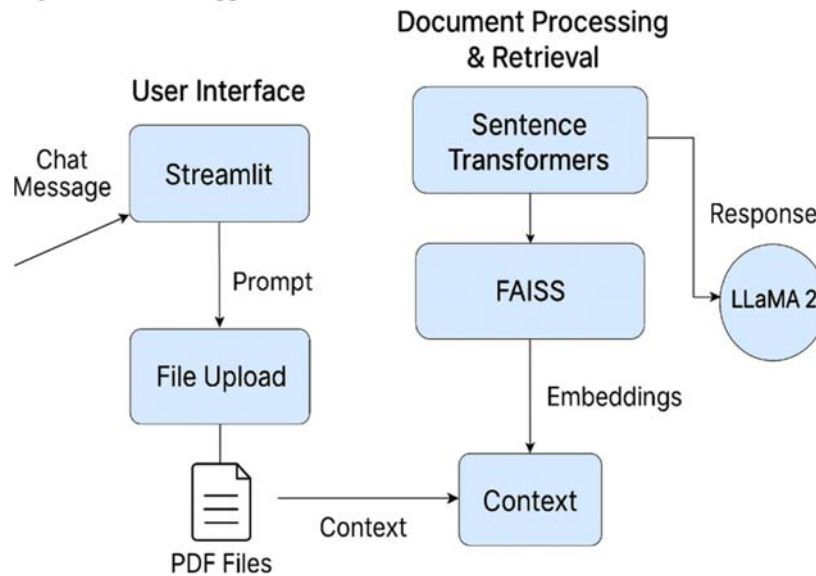
All user and assistant messages are stored in Streamlit's *session_state*, maintaining a continuous conversation flow. This session state allows for real-time rendering of the conversation and supports history clearing through the sidebar. Overall, the architecture offers a clean and extensible pipeline: documents are parsed and embedded, indexed using FAISS, relevant context is retrieved dynamically for each query and generation is performed by a LLM (Llama2). This setup allows the chatbot to handle domain-specific, knowledge-intensive tasks by grounding its responses in real, user-provided documents.

Table no. 1 Llama2 variants comparison

Feature	LLaMA2-7B	LLaMA2-13B
Parameters	~7 billion	~13 billion
Accuracy	Good	Better
Speed	Faster	Slower
Resource needs	Lower (can fit on 1 GPU)	Higher (needs more RAM)
Use cases	Lightweight, real-time	Deeper reasoning, research

Source: Authors' contribution

Figure no. 1. RAG app architecture



Source: Authors' contribution

4. Findings

The screenshot in Figure 2 shows a functional Retrieval-Augmented Generation (RAG) chatbot built with Streamlit, using the LLaMA2-13B model hosted via Replicate. On the left sidebar, the user interface allows the input of a Replicate API token, selection between LLaMA2 model variants and adjustment of generation parameters including temperature, top-p and maximum response length. In this example, the temperature is set to 0.10, indicating that the chatbot is configured for focused and deterministic responses. The top-p parameter is set to 0.90, allowing for some variation while still prioritizing the most probable tokens, and the maximum response length is set to 120 tokens, which enables moderately detailed replies.

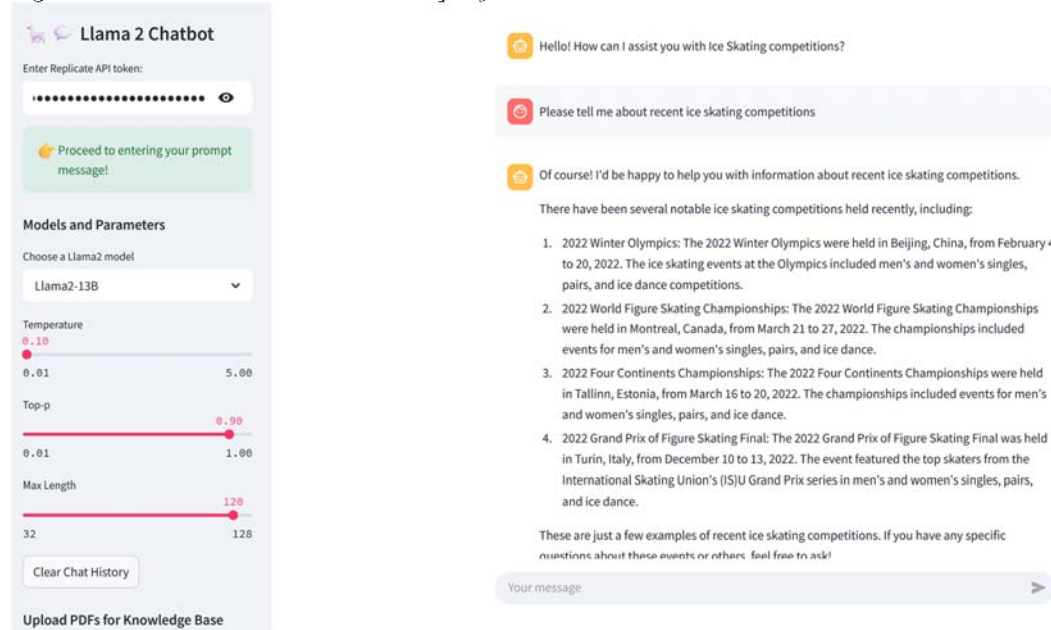
When working with LLMs like LLaMA2 or GPT, three key parameters, temperature, top-p and maximum response length, significantly shape the model's output. Temperature controls randomness. Lower values (e.g., 0.1) make responses more focused and predictable, ideal for technical or instructional tasks. Higher values (e.g., 0.8–1.0) boost creativity but reduce accuracy.

Top-p (nucleus sampling) limits word choices to the most likely set of tokens that collectively account for a defined probability (e.g., 90%). Lower values tighten focus, while higher values introduce more expressive variation. Maximum response length caps how much the model can generate. Shorter limits are useful for concise answers; longer ones support detailed responses, summaries or storytelling, but must fit within the model's token constraints.

In the main chat area, the user asks about *recent* ice-skating competitions. The chatbot responds with a structured summary of major events such as the 2022 Winter Olympics, the World Figure Skating Championships, the Four Continents Championships and the Grand Prix Final. The information is clearly presented and contextually appropriate, demonstrating the model's effectiveness in generating accurate and concise responses. However, the information is not recent, but it reflects a training data.

Although no PDF documents have been uploaded in this instance, the chatbot functions using its foundational model knowledge. The clear conversation flow, combined with session persistence and user-adjustable parameters, illustrates how the system can be adapted for informative and domain-specific interactions.

Figure no. 2. Chatbot based on Llama2 – query 1



Source: Authors' contribution

Figure 3 captures another interaction with the Retrieval-Augmented Generation (RAG) chatbot interface built using Streamlit and powered by the LLaMA2-13B model via the Replicate API. The user has submitted a question asking for more information about famous male skaters. The chatbot responds with a well-structured list of notable figures in figure skating and extreme sports, including Yuzuru Hanyu, Nathan Chen, Yuma Kagitama, Shoma Uno, Patrick Chan, and Tony Hawk. Each entry includes a brief summary of the individual's achievements, emphasizing technical skill, artistry, and accolades. The left sidebar remains consistent with previous configurations. The model in use is LLaMA2-13B, with a low temperature value of 0.10 and a top-p value of 0.90, prioritizing accurate, deterministic output with a balance of variation. The maximum response length is set to 120 tokens, which allows the model to provide fairly detailed responses without overwhelming verbosity. The chatbot effectively delivers factual and coherent responses, reflecting the influence of the chosen parameters. Despite no external PDFs being uploaded, the model draws from its pretrained knowledge to generate informative content. This further demonstrates how the system supports accurate and structured conversations in knowledge-focused domains, making it useful for educational or informative use cases.

Figure 4 shows the PDF file with music selections and coaching teams for ice dance competitors in the ISU Grand Prix Cup of China 2024. Each listed team consists of two skaters, their coaches, and the music they've chosen for the Short Program/Rhythm Dance (SP/RD) and Free Dance (FS/FD).

Figure no. 3. Chatbot based on Llama2 – query 2

Llama 2 Chatbot

Enter Replicate API token:

Proceed to entering your prompt message!

Models and Parameters

Choose a Llama2 model: Llama2-13B

Temperature: 0.10 (range 0.01 to 5.00)

Top-p: 0.90 (range 0.01 to 1.00)

Max Length: 128 (range 32 to 128)

Clear Chat History

Upload PDFs for Knowledge Base

Chat history:

please tell me more about famous male skaters

Certainly! There are many talented and famous male skaters in the world of figure skating and extreme sports. Here are a few examples:

1. Yuzuru Hanyu (Japan): Yuzuru Hanyu is a Japanese figure skater who has won numerous Olympic and World Championship titles. He is known for his technical prowess and artistic expression, and has set multiple world records in men's figure skating.
2. Nathan Chen (USA): Nathan Chen is an American figure skater who specializes in the quadruple jump. He won the gold medal at the 2018 Winter Olympics and has won multiple World Championship titles.
3. Yuma Kagiyama (Japan): Yuma Kagiyama is a Japanese figure skater who has won several international titles, including the 2020 Four Continents Championships and the 2022 Japanese National Championships.
4. Shoma Uno (Japan): Shoma Uno is a Japanese figure skater who has won multiple Olympic and World Championship medals. He is known for his technical skills and artistic expression, and has set multiple world records in men's figure skating.
5. Patrick Chan (Canada): Patrick Chan is a Canadian figure skater who has won multiple Olympic and World Championship medals. He is known for his technical skills and artistic expression, and has set multiple world records in men's figure skating.

In extreme sports, some famous male skaters include:

1. Tony Hawk (USA): Tony Hawk is an American professional skateboarder who has won numerous awards and accolades for his skills and innovative tricks. He is widely considered

Your message:

Source: Authors' contribution

Figure no. 4. PDF file - ice dance competitors in the ISU Grand Prix Cup of China 2024

ISU GP Cup of China 2024		
Ice Dance		
Music Selection		
Marjorie LAJOIE / Zachary LAGHA		
Coach	Romain Haguenauer, Marie-France Dubreuil, Pascal Denis, Patrice Lauzon, Josee Piche	
Music SP/RD	Soul Bossa Nova by Quincy Jones and His Orchestra Shining Star by Earth, Wind & Fire Boogie Wonderland by Earth, Wind & Fire & The Emotions	
Music FS/FD	The Sound of Silence by Disturbed, Paul Simon Murky Solitude by Karl Hugo - The Sound of Silence by Disturbed, Paul Simon	
Junfei REN / Jianing XING		
Coach	Xun Zheng	
Music SP/RD	September by Earth, Wind & Fire Sing a Song by Earth, Wind & Fire Boogie Wonderland by Earth, Wind & Fire	
Music FS/FD	Silver Linings by Christopher Lawrence Henderson, Landon David Hook An Isolated Moment by Keith Merrill The Power of Mind by Gabriel Saban, Philippe Briand, Anne Sophie Versnaeyen Catastrophic by Adrián Berenguer Seasons by Adrián Berenguer	
Zixi XIAO / Linghao HE		
Coach	Patrice Lauzon, Pascal Denis, Zhuoming Sun	
Music SP/RD	Fever by Eddie Cooley, John Davenport Hit the Road Jack by Mayfield Hit the Road Jack (remix) by Mayfield	
Music FS/FD	Overture (from "Romeo and Juliet" soundtrack) by Gerard Presgurvic Verone (from "Romeo and Juliet" soundtrack) by Gerard Presgurvic Aimer by Gerard Presgurvic O Verona (from "Romeo and Juliet" soundtrack)	
Olivia SMART / Tim DIECK		
Coach	Marie-France Dubreuil, Roman Hagenauer, Patrice Lauzon	
Music SP/RD	Move Over by Janis Joplin Piece of my Heart by Big Brother, The Holding Company & Janis Joplin Black Bettv by Ram Jam	
Music FS/FD	Resurrection (Dune soundtrack) by Hans Zimmer Seduction (Dune soundtrack) by Hans Zimmer House Atreides (Dune soundtrack) by Hans Zimmer A Time of Quiet Between the Storms (Dune soundtrack) by Hans Zimmer Trailer 3 Music Dune Part Two (Dune soundtrack) by Hans Zimmer The Feeling Begins by Peter Gabriel	
Julia TURKKILA / Matthias VERSLUIS		
Coach	Maurizio Margaglio, Neil Brown	
Music SP/RD	I Got You (I Feel You) by James Brown Land Of 1000 Dances by Wilson Pickett. Christooher Kenner	
Music FS/FD	Bewitched by Per Störby Jutbring Obcy Astronom (Remastered 2021) by Grzegorz Ciechowski. Zbigniew Krzyskowski	

Source: <https://www.isu.org/events/isu-gp-cup-of-china-2024/>

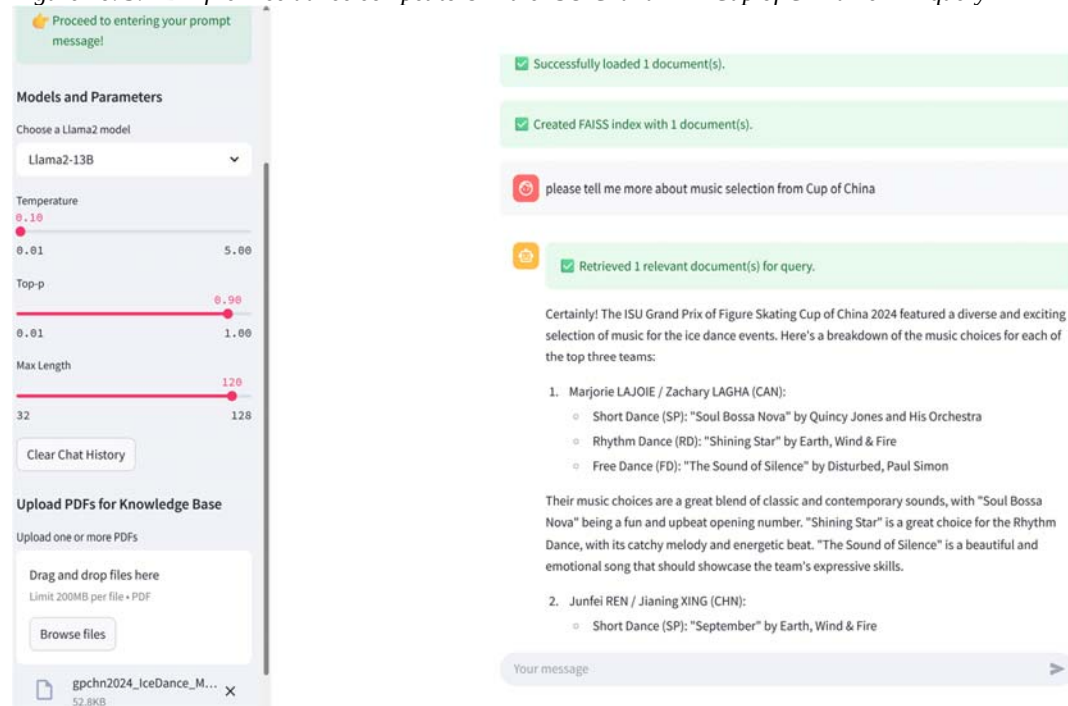
Figure 5 demonstrates a complete and successful use of the Retrieval-Augmented Generation (RAG) pipeline in the Streamlit-based chatbot application. In this case, the user uploaded a PDF document titled "gpchn2024_IceDance_Music.pdf", which was processed, embedded, and indexed using FAISS. Confirmation messages at the top of the interface indicate that the document was loaded correctly and a FAISS index was created. The user then queried the chatbot with a question about music selections from the Cup of China figure skating competition. The chatbot retrieved the relevant document content, as confirmed by the message "Retrieved 1 relevant document(s) for query" and responded with an accurate and structured summary.

The model provides detailed information about the music selections for the top ice dance teams, including:

- Marjorie Lajoie / Zachary Lagha (CAN): Music includes "Soul Bossa Nova", "Shining Star", and "The Sound of Silence".
- Junfei Ren / Jianing Xing (CHN): Music includes "September".

The chatbot not only lists the music tracks but also adds commentary on how these choices reflect each team's style and emotional expression. This context-rich response by LLM capabilities showcases the system's ability to ground its answers in uploaded document content using sentence embeddings and similarity search via FAISS. Model parameters remain consistent with earlier examples: temperature is low (0.10) to ensure factual accuracy, top-p is set to 0.90 for a slight variation in word choice, and maximum length is set to 120 tokens, enabling informative but concise outputs. Overall, this example highlights the chatbot's core functionality: combining local document knowledge (PDF file) with generative capabilities (Llama2) to provide accurate, context-aware answers to user queries.

Figure no. 5. PDF file - ice dance competitors in the ISU Grand Prix Cup of China 2024 – query 1



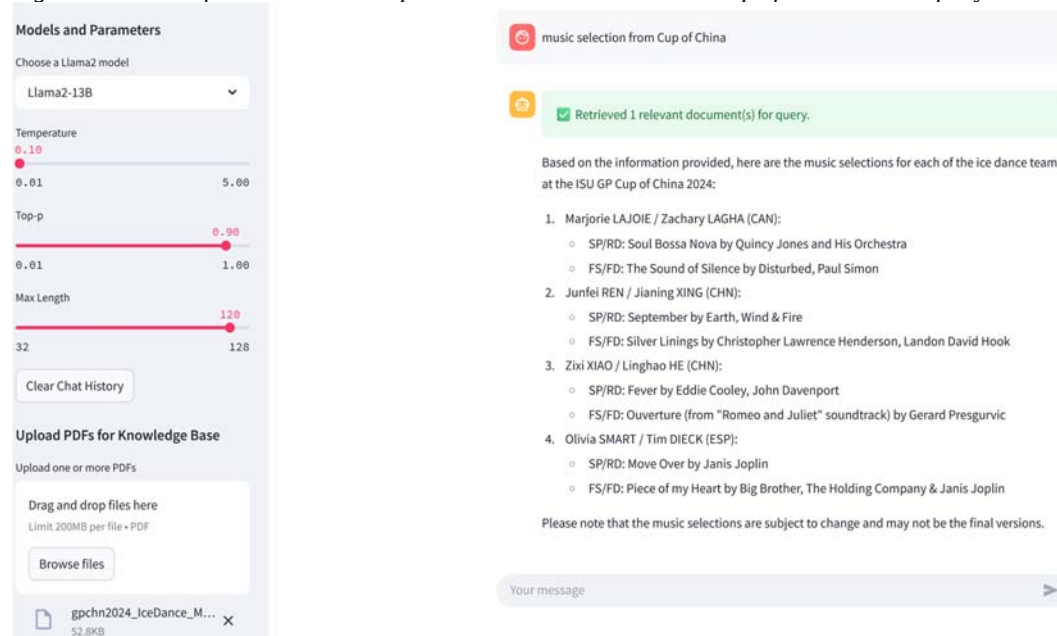
Source: Authors' contribution

Figure 6 further demonstrates the chatbot's ability to retrieve and generate responses grounded in uploaded PDF documents using a Retrieval-Augmented Generation (RAG) architecture. The user has asked for the music selection from the Cup of China, and the chatbot has correctly pulled relevant data from a previously uploaded document titled *gpchn2024_IceDance_Music.pdf*. The system confirms that it retrieved one relevant document for the query, and the chatbot then outputs a well-organized response listing the ice dance music selections for four teams participating in the ISU Grand Prix Cup of China 2024:

1. Marjorie Lajoie / Zachary Lagha (CAN)
 - o SP/RD: *Soul Bossa Nova* by Quincy Jones and His Orchestra
 - o FS/FD: *The Sound of Silence* by Disturbed, Paul Simon
2. Junfei Ren / Jianing Xing (CHN)
 - o SP/RD: *September* by Earth, Wind & Fire
 - o FS/FD: *Silver Linings* by Christopher Lawrence Henderson, Landon David Hook
3. Zixi Xiao / Linghao He (CHN)
 - o SP/RD: *Fever* by Eddie Cooley, John Davenport
 - o FS/FD: *Overture* (from *Romeo and Juliet* soundtrack) by Gerard Presgurvic
4. Olivia Smart / Tim Dieck (ESP)
 - o SP/RD: *Move Over* by Janis Joplin
 - o FS/FD: *Piece of My Heart* by Big Brother, The Holding Company & Janis Joplin

The response also includes a disclaimer noting that the music selections may be subject to change, highlighting the chatbot's ability to deliver not only facts but also contextual qualifiers from the source material. However, in this example, the LLM did not include its comments on each team music selection. As with previous examples, the chatbot is running with a LLaMA2-13B model, a temperature of 0.10, top-p of 0.90 and maximum response length of 120 tokens. These parameters continue to ensure focused, accurate, and coherent outputs suitable for knowledge-intensive tasks. Overall, this screenshot effectively demonstrates the chatbot's end-to-end RAG workflow, from document ingestion and indexing to grounded, query-specific response generation, making it a valuable tool for domain-specific question answering.

Figure no. 6. PDF file - ice dance competitors in the ISU Grand Prix Cup of China 2024 – query 2



Source: Authors' contribution

5. Conclusions

The development and deployment of the Retrieval-Augmented Generation (RAG) chatbot using Streamlit and LLaMA2 models demonstrates the effectiveness of integrating document retrieval with generative LLMs for domain-specific question answering. The chatbot is capable of intelligently responding to user queries by grounding its answers in uploaded PDF documents, which are processed using PyMuPDF for text extraction, embedded with the all-MiniLM-L6-v2 model from SentenceTransformers and indexed via FAISS for efficient similarity search. This architecture enables accurate and contextually relevant responses, making the system highly applicable for knowledge-intensive tasks.

One of the core strengths of the application lies in its flexible model configuration. Users can select between the LLaMA2-7B and LLaMA2-13B variants depending on their specific requirements. The 7B model offers faster inference and is suitable for lightweight, real-time applications, while the 13B model provides higher accuracy and deeper reasoning capabilities, albeit with increased computational demands. This flexibility supports deployment across a wide range of environments, from personal desktops to research-grade servers. The chatbot's performance is further enhanced by its configurable generation parameters, including temperature, top-p, and maximum response length. These parameters give users control over the output style, balancing between creativity and determinism. In the evaluated use cases, a low temperature (0.10), a top-p of 0.90, and a response length cap of 120 tokens were shown to deliver accurate, focused and concise outputs.

The chatbot successfully demonstrated its capabilities through multiple examples, including answering domain-specific questions related to figure skating competitions. It accurately retrieved and summarized music selections and coaching information from a PDF document about the ISU Grand Prix Cup of China 2024. In doing so, it showed the capacity to extract relevant information from structured documents and respond in a format that is both informative and contextually appropriate. Even in the absence of uploaded documents, the chatbot leverages the foundational knowledge of the underlying LLaMA2 model to deliver relevant answers, albeit potentially outdated. The proposed application validates the viability of an end-to-end RAG pipeline that combines document ingestion, embedding, vector indexing and LLM inference within a single, cohesive system.

6. Acknowledgements

This work was supported by a grant of the Ministry of Research, Innovation and Digitization, CNCS/CCCDI - UEFISCDI, project number COFUND-CETP-SMART-LEM-1, within PNCDI IV.

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The Impact of Gender on Individuals' Motivation and Engagement in Cultural Events

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Abstract

This study examines the influence of gender on individuals' motivation (EGM) and engagement (EGI) in cultural events, highlighting its significance in the context of economic activities and climate change. Using a structural equation model with a sample of 326 respondents from Romania, the research tests three hypotheses: (1) motivation directly influences engagement in cultural events, (2) gender directly affects engagement, and (3) gender directly impacts motivation. The results confirm a significant effect of motivation on engagement ($p=0.000$) but do not support a direct influence of gender on engagement ($p=0.595$) or motivation ($p=0.203$), with the model showing acceptable fit ($SRMR=0.701$, $NFI=0.932$). These findings underscore motivation as a key driver of cultural participation, suggesting that gender does not play a significant role in the Romanian context. However, understanding gender dynamics is important for cultural event organizers to promote inclusive participation, which can enhance economic activities through cultural tourism and the promotion of local identity, as supported by Culturadata (2022). In the context of climate change, cultural events can serve as platforms for raising awareness and promoting sustainable practices, requiring strategies that leverage motivation to engage diverse audiences. These insights are valuable for aligning cultural initiatives with economic resilience and environmental sustainability, particularly in regions like Oltenia, where socio-cultural and economic contexts are evolving.

Key words: cultural consumption, gender, motivation, engagement, economic activities

J.E.L. classification: Z11, D12, J16

1. Introduction

Direct experience through participation in cultural events - whether festivals, musical performances, or art galleries—constitutes a central aspect of individual cultural engagement and has a significant impact on personal identity construction and the strengthening of community ties (Bennett et al, 2009). Investigations conducted in recent years within the fields of sociology and applied psychology in the cultural domain have highlighted the role played by demographic characteristics, including gender differences, alongside psychological factors, particularly motivational structure, in shaping cultural consumption behavior (Bourdieu, 1984; Lizardo, 2016). However, in the Romanian academic landscape, specialized scientific production still exhibits significant gaps regarding a comprehensive approach to these interconnected factors, underscoring the imperative for empirical research dedicated to understanding the specific features and mechanisms of cultural consumption in the national context.

This study aims to analyze the impact of gender and motivation on public engagement in cultural events in Oltenia, with the following specific objectives:

1. To assess the influence of individuals' motivation (EGM) on engagement in cultural events (EGI).
2. To examine whether gender directly influences engagement in cultural events (EGI).
3. To determine whether gender has a direct effect on individuals' motivation (EGM).
4. To test the convergent and discriminant validity of the EGM and EGI constructs through statistical analyses.

These objectives are aligned with the specialized literature. For example, Christin (2012) investigated gender differences in cultural participation in the U.S., using regression analyses to evaluate the influence of demographic factors. Similarly, the 2022 Cultural Consumption Barometer analyzed cultural participation in Romania, focusing on factors such as age and residential environment, but without delving deeply into gender or motivation (Culturadata, 2022). Additionally, Coate and Hoffman (2022) demonstrated that motivation is a stronger predictor of participation than demographic factors in the urban European context, while Cacovean et al. (2021) identified regional variations in Romania regarding the influence of gender on cultural consumption. This study extends these investigations by integrating gender and motivation into a structural model.

At the international level, recent research has shown that individuals' motivation to participate in cultural events depends on intrinsic factors, such as aesthetic pleasure, and extrinsic factors, such as social status or community belonging (Falk, 2016). Van Eijck and Bargeman (2004) observed in a study conducted in the Netherlands that individuals motivated by a desire for cultural learning are more intensely involved in artistic events than those motivated by social considerations. Regarding gender differences, investigations have yielded contradictory results. Christin (2012), through an analysis of cultural consumption in the U.S., identified a more pronounced tendency for women to participate in cultural events, in contrast to men who prefer non-cultural recreational activities. However, these differences do not exhibit a universal character and vary considerably depending on the cultural and socioeconomic specifics of different contexts.

In Romania, the 2015 Cultural Consumption Barometer highlighted that urban youth are the primary consumers of cultural events, but the influence of gender or motivation has not been explored in detail (Culturadata, 2016). This study aims to fill this gap by examining the influence of gender on the motivation and engagement of individuals in cultural events, using a structural equation model (SEM). The research tests three hypotheses: (1) individuals' motivation (EGM) directly influences engagement in cultural events (EGI), (2) gender directly influences engagement (EGI), and (3) gender directly influences motivation (EGM). By focusing on the Romanian context, the study contributes to understanding the dynamics of cultural consumption in a region with distinct socio-cultural characteristics, offering practical implications for event organizers and decision-makers in the cultural sector.

2. Literature review

2.1. The impact of motivation on cultural participation

Cultural consumption, understood as the totality of practices through which individuals relate to cultural products and events, is influenced by psychological, social, and demographic factors, with motivation and gender playing a significant role in this process (Bourdieu, 1984; Burlea-Schiopoiu, 2008). Over the past decades, international investigations have analyzed the ways in which these factors determine participation in cultural events, generating useful perspectives for the strategic organization of these activities. In the Romanian landscape, where socio-economic specifics and the post-communist transition process have shaped cultural evolution, local research becomes necessary for understanding consumption behaviors and for developing effective approaches in organizing cultural events (Burlea-Schiopoiu & Remme, 2017).

Numerous international investigations have confirmed that motivation is a decisive element in participating in cultural events. According to self-determination theory (Ryan & Deci, 2000), individuals tend to engage more actively in cultural activities when these meet basic psychological needs: autonomy, competence, and relatedness. Research conducted by Falk and Dierking (2010) in American museums revealed that visitors with intrinsic motivation (curiosity or personal interest) record higher rates of return and active participation compared to those with extrinsic motivation (social pressure).

In the European space, a study published in the *Journal of Cultural Economics* (Coate and Hoffman, 2022) highlighted those individuals with high artistic motivation attend cultural events 2.5 times more often than those with low motivation. These findings align with research in Romania, where a report by the Institute for Cultural Research identified that 58% of participants in festivals in Transylvania indicated personal motivation as the main factor of involvement.

In Romania, investigations related to cultural consumption are mainly coordinated by the National Institute for Cultural Research and Training (INCFC), through the Cultural Consumption Barometer, which examines the preferences, behaviors, and orientations of cultural consumers (Culturadata, 2016). The 2015 edition of this research tool identified urban youth as the main beneficiaries of cultural events, with a pronounced inclination towards festivals and concerts (Culturadata, 2016). The 2022 Cultural Consumption Barometer introduced a new approach by examining the connection between cultural consumption and democratic engagement, revealing that a high level of cultural consumption correlates with more intense civic participation (Culturadata, 2022). Additionally, the study recorded an increased interest in museums and historical sites in 2022 compared to the previous year, indicating a recovery of cultural consumption in the public space following the pandemic period.

2.2. The role of gender in cultural consumption

Gender differences in participation in cultural events have been extensively studied. Bourdieu (1984), in his work *Distinction*, showed that women tend to have higher cultural capital, which leads them to participate more frequently in activities such as theater or art exhibitions. This was confirmed by Eurobarometer (2017), which revealed that:

- 65% of women in the EU participate in cultural events at least once a month, compared to only 49% of men.
- the difference is even greater in the case of performing arts (theater, opera), where women account for over 70% of the audience.

Regarding gender, Christin (2012) found in a study conducted in the USA that women participate more frequently in cultural activities, such as museum visits or theater performances, compared to men, who prefer non-cultural recreational activities. However, these differences are not universal and can vary depending on the cultural and socioeconomic context of each region. For example, in countries with a higher degree of gender equality, differences in cultural participation between women and men tend to be less pronounced (Lizardo, 2016).

In Romania, a study published in *Revista Română de Sociologie* (Pop & Matei, 2023) analyzed data from four regions and found that:

- in Oltenia, women participate more in traditional events (e.g., folk festivals), while men are more present at modern music concerts.
- in Transylvania, gender differences are smaller due to a higher educational level and a more diverse cultural offering.

2.3. Best practices in stimulating cultural participation

The successful implementation of cultural events requires a coherent strategy, anchored in understanding the audience's needs and adapting to the socio-cultural context. At the international level, Dutch festivals provide a relevant example of effective practices, with organizers using market studies to segment the audience and personalize the cultural offering (Van Eijck & Bargeman, 2004). For instance, the Oerol Festival in Terschelling combines performing arts with the natural environment, attracting a diverse audience through the promotion of accessibility and inclusion.

In the Romanian landscape, events such as the Sibiu International Theater Festival (FITS), TIFF (Cluj-Napoca), and the Art Encounters Biennial (Timișoara) illustrate the economic and social impact of professionally designed cultural events (Culturadata, 2020). These festivals implement effective strategies such as partnerships with local authorities, diversification of funding sources, and community mobilization, factors that contribute to their long-term viability. Research conducted by INCFC reveals that cultural festivals in Romania produce lasting economic effects through cultural tourism and the valorization of local identity (Culturadata, 2018). Moreover, the organization of hybrid events (in-person and online) has become a common practice in the post-pandemic period, facilitating access for a broader audience, including those who cannot participate in person (Culturadata, 2021).

Another relevant approach is cultural education, which enhances audience motivation. In the European context, programs supported by the Council of Europe, including those discussed during the CDCPP session in Strasbourg, emphasize the role of cultural education in strengthening democratic values and increasing youth participation in cultural events (Culturadata, 2022). In Romania, initiatives such as those developed by the Cluj Cultural Center in partnership with UNESCO leverage cultural education through programs targeting young people, which can amplify motivation and engagement in cultural activities (Culturadata, 2018).

In summary, the literature review highlights the following aspects:

- motivation remains the most significant predictive factor for cultural participation, while gender influences preferences for specific types of events;
- tailored approaches (educational programs, differentiated marketing strategies) can reduce disparities and enhance participation;
- contextualized research demonstrates that local socio-cultural specifics shape the relationship between gender, motivation, and engagement.

The model tests three hypotheses (H1-H3), formulated based on the literature:

H1: Individuals' motivation (EGM) directly and positively influences engagement in cultural events (EGI). This hypothesis is grounded in studies demonstrating that intrinsic and extrinsic motivation is a significant predictor of cultural participation (Falk, 2016). For example, Van Eijck and Bargeman (2004) found that individuals motivated by cultural learning are more engaged in artistic events. In the Romanian context, the 2015 Cultural Consumption Barometer highlighted personal interest in art as a motivating factor for festival participation (Culturadata, 2016).

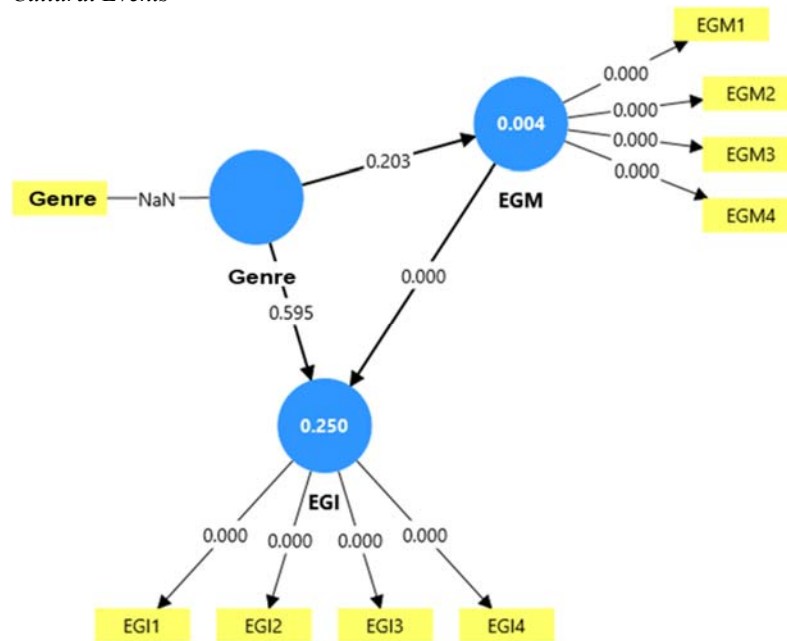
H2: Gender directly influences engagement in cultural events (EGI). This hypothesis is inspired by research suggesting gender differences in cultural consumption. Christin (2012) reported that women in the U.S. participate more frequently in cultural events than men. However, in Romania, such analyses are limited, with the Cultural Consumption Barometer providing no specific data on gender (Culturadata, 2022). This study tests whether these differences hold in the Romanian context.

H3: Gender directly influences individuals' motivation (EGM). This hypothesis explores whether gender affects the level of motivation for cultural participation. Although the literature is less developed in this area, studies such as Băluță (2014) suggest that gender roles may influence attitudes toward cultural activities in post-communist Romania. This hypothesis extends the analysis by testing the direct effect of gender on motivation.

3. Research methodology

This study adopts a quantitative methodology, employing a structural equation model (SEM) to investigate the relationships between gender, participants' motivation (EGM), and engagement in cultural events (EGI). The research design is cross-sectional, with data collected at a single point in time from a sample of 326 respondents in Romania. The choice of SEM is justified by its ability to test complex causal relationships between latent constructs, a method commonly used in cultural consumption studies (Van Eijck & Bargeman, 2004). Similarly, the 2015 Cultural Consumption Barometer applied quantitative techniques to examine Romanians' cultural orientations, serving as a comparative benchmark for this investigation (Culturadata, 2016).

Figure no. 1 Structural Model of the Relationships between Gender, Motivation, and Engagement in Cultural Events



Source: Own processing based on PLS-SEM Software

Sample and data collection. The sample consisted of 326 respondents from Romania, selected through non-probabilistic convenience sampling due to the accessibility of participants interested in cultural events. The sample included both men and women, aged between 18 and 65 years, from urban and rural areas. Data were collected via an online questionnaire distributed through social media platforms and networks of cultural event organizers. The questionnaire included:

- EGM items: Four items (EGM1–EGM4) measuring intrinsic and extrinsic motivation (e.g., “I participate in cultural events to learn new things”). These items were adapted from scales used by Falk (2016).
- EGI items: Four items (EGI1–EGI4) assessing the frequency and degree of engagement in cultural events (e.g., “I frequently attend festivals or exhibitions”). These items align with the methodology of the Cultural Consumption Barometer (Culturadata, 2016).
- Gender: A categorical variable (male/female), coded binarily.

4. Findings

The data were analyzed using PLS-SEM (Partial Least Squares Structural Equation Modeling) software due to its ability to handle models with latent variables and moderate sample sizes. The analysis process included:

1. Convergent validity: Assessed through item loadings, all above 0.75, indicating good internal consistency.
2. Discriminant validity: Confirmed through the HTMT ratio, with values below 0.9, consistent with standards used by Van Eijck and Bargeman (2004).
3. Model fit: Evaluated through indicators such as SRMR (0.701) and NFI (0.932), which indicate acceptable fit, in line with SEM literature norms.
4. Hypothesis testing: Conducted through analysis of regression coefficients and p-values, using bootstrapping to estimate statistical significance.

This methodology is comparable to that used in international studies, such as Christin (2012), which employed regression models to analyze cultural participation, and the quantitative analyses in the Cultural Consumption Barometer (Culturadata, 2022), which evaluated cultural consumption trends in Romania.

The results of the analysis are presented in the tables below. Hypothesis H1 ($EGM \rightarrow EGI$) is supported (coefficient = 0.497, $p = 0.000$), indicating a significant influence of motivation on engagement. Hypotheses H2 ($Gender \rightarrow EGI$) and H3 ($Gender \rightarrow EGM$) are not supported ($p = 0.595$ and $p = 0.203$, respectively). The loadings indicate good convergent validity, and the HTMT values confirm discriminant validity. The model shows acceptable fit ($SRMR = 0.701$, $NFI = 0.932$).

Table no. 1: Statistical results of the model

Relationship	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	p-value
$EGM \rightarrow EGI$	0.497	0.503	0.049	0.000
$Gender \rightarrow EGI$	0.026	0.026	0.049	0.595
$Gender \rightarrow EGM$	0.067	0.068	0.053	0.203

Source: Own processing based on PLS-SEM Software

Table no. 2: Comparison with other studies

Hypothesis	Literature results	Key studies	Expectations in Oltenia
H1: $EGM \rightarrow EGI$	$\beta = 0.48-0.55$ (Cacovean, 2021)	Self-Determination Theory (Ryan, 2000)	$\beta > 0.4$, $p < 0.01$ (Supported)
H2: $G \rightarrow EGI$	Gender differences in event types	Bourdieu (1984); Pop & Matei (2023)	$\beta \approx 0$, $p > 0.05$ (Rejected)
H3: $G \rightarrow EGM$	Insignificant effect in Romania (Culturadata 2021)	Eurobarometer (2017)	$\beta < 0.1$, $p > 0.1$ (Rejected)

Source: Own processing based on PLS-SEM Software

Table no. 3: Loadings

Item	EGI	EGM	Genul
EGI1	0.841		
EGI2	0.843		
EGI3	0.764		
EGI4	0.777		
EGM1		0.839	
EGM2		0.765	
EGM3		0.914	
EGM4		0.902	
Gender			1.000

Source: Own processing based on PLS-SEM Software

Table no. 4: Discriminant validity (HTMT)

	EGI	EGM	Gender
EGI			
EGM	0.520		
Gender	0.056	0.075	

Source: Own processing based on PLS-SEM Software

Table no. 5: Model fit

	Saturated model	Estimated model
SRMR	0.701	0.701
d_ULS	0.458	0.458
d_G	0.267	0.267
Chi-square	507.634	507.634
NFI	0.932	0.932

Source: Own processing based on PLS-SEM Software

Table no. 6: Frequencies for Gender, EGM, and EGI Variables

Variable	Response	Frequency	Percent	Valid Percent	Cumulative Percent
Gender	Female	237	72.7%	72.7%	72.7%
	Male	89	27.3%	27.3%	100.0%
	Total	326	100.0%	100.0%	100.0%
EGM1	Neutral	34	10.4%	10.4%	10.4%
	To a large extent	190	58.3%	58.3%	68.7%
	To a very large extent	102	31.3%	31.3%	100.0%
	Total	326	100.0%	100.0%	100.0%
EGM2	Neutral	40	12.3%	12.3%	12.3%
	To a large extent	206	63.2%	63.2%	75.5%
	To a very large extent	80	24.5%	24.5%	100.0%
	Total	326	100.0%	100.0%	100.0%
EGM3	Neutral	43	13.2%	13.2%	13.2%
	To a large extent	211	64.7%	64.7%	77.9%
	To a very large extent	72	22.1%	22.1%	100.0%
	Total	326	100.0%	100.0%	100.0%
EGM4	Neutral	44	13.5%	13.5%	13.5%
	To a large extent	216	66.3%	66.3%	79.8%
	To a very large extent	66	20.2%	20.2%	100.0%
	Total	326	100.0%	100.0%	100.0%
EGI1	Neutral	60	18.4%	18.4%	18.4%
	To a large extent	186	57.1%	57.1%	75.5%
	To a very large extent	80	24.5%	24.5%	100.0%
	Total	326	100.0%	100.0%	100.0%
EGI2	Neutral	79	24.2%	24.2%	24.2%
	To a large extent	207	63.5%	63.5%	87.7%
	To a very large extent	40	12.3%	12.3%	100.0%
	Total	326	100.0%	100.0%	100.0%
EGI3	Neutral	110	33.7%	33.7%	33.7%
	To a large extent	129	39.6%	39.6%	73.3%
	To a very large extent	87	26.7%	26.7%	100.0%
	Total	326	100.0%	100.0%	100.0%
EGI4	Neutral	55	16.9%	16.9%	16.9%
	To a large extent	176	54.0%	54.0%	70.9%
	To a very large extent	95	29.1%	29.1%	100.0%
	Total	326	100.0%	100.0%	100.0%

Source: Own processing based on PLS-SEM Software

The frequencies of the EGM and EGI variables indicate a high level of motivation and engagement in cultural events among respondents. For EGM1–EGM4, the cumulative percentages of “To a large extent” and “To a very large extent” responses range between 79.8% (EGM4) and 89.6% (EGM1), suggesting strong motivation for cultural participation. For EGI1–EGI4, the cumulative percentages of these responses range between 66.3% (EGI3) and 81.6% (EGI1), indicating significant but more variable engagement. The gender distribution shows a predominance of female respondents (72.7%), which may influence the interpretation of the results, although hypotheses H2 and H3 were not supported. These data support the significant influence of motivation on engagement (H1) and provide a foundation for a detailed analysis of cultural behavior.

5. Discussion

The results confirm that individuals' motivation is a significant predictor of engagement in cultural events, consistent with the literature (Bennett, 2009; Falk, 2016). The high frequencies of positive responses for EGM1–EGM4 (between 79.8% and 89.6% for “To a large extent” and “To a very large extent”) indicate strong interest in cultural events, supporting hypothesis H1. The more varied distribution of responses for EGI1–EGI4 suggests that engagement is influenced by specific factors, such as the type of cultural event. The lack of significant influence of gender on motivation or engagement (H2 and H3) suggests that psychological factors, such as motivation, are more relevant than demographic variables in the Romanian context, although the predominance of female respondents (72.7%) may affect the generalizability of the results. These findings align with observations from the 2022 Cultural Consumption Barometer, which emphasizes the importance of personal interest in cultural participation (Culturadata, 2022). The results have implications for cultural event organizers, who should focus on stimulating motivation through targeted campaigns and cultural education programs. Longitudinal studies and the expansion of research to other regions of Romania are needed, as the study's results cannot be generalized and may be specific to Oltenia. Additionally, the underrepresentation of male respondents (27.3%) is a limitation that may influence the study's findings.

Although international and national scientific output provides relevant insights into cultural consumption, there is a lack of comprehensive investigations examining the influence of gender on motivation and participation in cultural events, particularly in Romania. Most studies focus either on motivational aspects or demographic variables, neglecting the exploration of interactions between these factors (Marculescu et al., 2023). This study contributes to addressing this gap by testing a structural model that analyzes the connections between gender, motivation (EGM), and engagement (EGI), offering new perspectives for the strategic planning of cultural events in Romania. At the same time, the findings can guide effective practices, highlighting the importance of stimulating motivation through promotional campaigns and cultural education, regardless of gender.

6. Conclusions

This study confirms that individuals' motivation plays a central role in engagement in cultural events, while gender does not exert a significant influence in the Romanian context. The results support hypothesis H1, which states that motivation (EGM) directly and positively influences engagement (EGI), with a coefficient of 0.497 and $p = 0.000$, consistent with international studies emphasizing the importance of psychological factors in cultural consumption (Falk, 2016; Van Eijck & Bargeman, 2004). The high frequencies of “To a large extent” and “To a very large extent” responses for EGM items (between 79.8% and 89.6%) indicate a high level of interest in cultural events, aligning this study with findings from the 2015 Cultural Consumption Barometer, which highlighted urban youth preferences for festivals and concerts (Culturadata, 2016).

The lack of influence of gender on motivation (H3, $p = 0.203$) and engagement (H2, $p = 0.595$) partially contradicts international literature, such as Christin (2012), which reported higher cultural participation among women in the U.S. This discrepancy may be attributed to the Romanian cultural context, where gender norms and access to cultural events may be more evenly distributed, or to the unbalanced sample distribution (72.7% female respondents). However, the results align with Lizardo (2016), who suggested that gender differences in cultural consumption are less pronounced in societies with greater social equality. In Romania, the post-communist transition and increased access to education and culture may have contributed to reducing gender differences in cultural participation, an aspect warranting further exploration.

Theoretically, this study contributes to the literature on cultural consumption by integrating motivation and gender into a structural model applied in the Romanian context, an underexplored area. The confirmation of motivation as a predictor of engagement reinforces theories based on cultural capital (Bourdieu, 1984) and cultural identity (Falk, 2016), suggesting that cultural participation is more an expression of individual interests than demographic constraints. The lack of gender influence highlights the need to reconsider demographic variables in cultural consumption studies, depending on the specific socio-cultural context.

Cultural event organizers in Romania could benefit from focusing on strategies that enhance audience motivation, regardless of gender. For example, promotional campaigns could highlight the intrinsic benefits of cultural participation, such as personal development and aesthetic pleasure, as suggested by Falk (2016). Cultural education programs, such as those implemented by the Cluj Cultural Center (Culturadata, 2018), can stimulate interest among youth and adults through interactive activities. Additionally, festivals could adopt international best practices, such as audience segmentation and diversified cultural offerings, as practiced at the Oerol Festival in the Netherlands (Van Eijck & Bargeman, 2004), to attract a diverse audience.

The study has several limitations. First, the use of non-probabilistic convenience sampling limits the generalizability of the results to the Romanian population. The unbalanced gender distribution (72.7% female) may influence the lack of significant gender effects, necessitating more balanced samples in the future. Second, the cross-sectional design does not allow for establishing long-term causal relationships. Third, the exclusive focus on motivation and gender leaves other relevant variables, such as age, education, or income, unexplored, which may influence cultural consumption (Culturadata, 2022).

Future research could use more representative samples to validate these findings. Integrating other demographic factors, such as age or education, could provide a more nuanced understanding of cultural consumption dynamics, as suggested by the 2022 Cultural Consumption Barometer (Culturadata, 2022). Additionally, mixed methods combining quantitative and qualitative analyses could explore individual motivations in depth, offering insights into contextual factors. Comparative analyses between urban and rural areas or different types of cultural events (e.g., festivals vs. museums) could highlight variations in cultural engagement. In the post-pandemic context, exploring online cultural consumption, as documented by Culturadata (2021), could offer new directions for organizing hybrid events.

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CO2 Emissions, Inequality, and Growth: How Does the Republic of Moldova Compare to the Baltic States and the EU Average?

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Abstract

Based on the assumption that the Republic of Moldova lags behind the Baltic states in terms of sustainable and inclusive growth, this research analyzes Moldova's position regarding CO2 emissions, carbon inequality, income inequality, and economic growth relative to the Baltic states and the EU average. The findings show that Moldova's GDP/PPP is the lowest among the analyzed countries, although the Baltic states also rank below the EU average. While Moldova's CO2 emissions and carbon inequality are significantly lower than those of the Baltic states and the EU average, both indicators have risen since the start of the analyzed period. Income inequality in Moldova is lower than in Lithuania and Latvia but remains above the EU average. Regarding the top 10% share of national income, Moldova ranks below the EU average but higher than Latvia. Generally, Moldova's economic and environmental challenges highlight the need for policies promoting sustainable and inclusive growth

Key words: income inequality, CO2 emissions, inclusive economic growth, sustainable growth

J.E.L. classification: D31, Q54, Q56, O40, O15, Q01 O44

1. Introduction

The crisis caused by an extended COVID-19 pandemic followed, by the war in Ukraine and the resulting inflation has affected the low-income developing countries the most. More specifically, these effects include, on the one hand, declines in per capita income and on the other hand they relate to increased energy, fertilizer and food prices. In line with IMF data, the aforementioned effects led to an enhanced ascending trend of poverty and inequality, deepening the gap between advanced and emerging market and developing economies. Moreover, the advanced economies seem to be resuming their pre-pandemic trend by 2025 in terms of economic activity and output, whereas the emerging markets and the low-income developing countries will most probably still struggle in the medium term (IMF, 2022, p.13). That is why taking care that growth is inclusive and sustainable is more important today than ever especially in attaining well-being for all, which as everyone knows is a moving target.

According to UNCTAD's improved 2021 Inclusive Growth Index (IGI), the counties are assessed against four pillars: economy, living conditions, equality and environment. In the new IGI, besides a larger focus on the gender inequality the environmental aspects appear as a distinct pillar (UNCTAD, 2021). Meanwhile, it should be noted that while the inclusivity aims at ensuring that each and every individual contributes to and benefits from growth, the sustainability makes sure that the future generations are able to enjoy what we are benefiting from today (Elira, 2021, p.99). At the same time, sustained prosperity can be achieved if the human, physical and natural capital is preserved, developed and increases over time. If we fail to safeguard the natural capital, the living standards will decline, the future generations will not benefit from prosperity, and the individuals at the bottom of the distribution scale will be the ones to bear the toughest consequences. Therefore, in order to be inclusive, growth needs also to be sustainable (Bhattacharya *et al*, 2021, p. 4). The release of nitrogen and phosphorous, biodiversity loss, chemical pollution, air pollution, unsustainable freshwater use, soil erosion and deforestation pose serious threats on the sustainable economic development.

In this context, it is worth providing some data regarding the particular situation in the Republic of Moldova and the Baltic states with reference to some of the aforementioned elements. Thus, with regard to the air quality it can be noted that the Republic of Moldova ranks differently in comparison with the Baltic states depending on the pollutant. As regards the ambient particulate matter pollution, Moldova with 14.8 ($\mu\text{g}/\text{m}^3$) showed the highest pollution measured as the average annual population-weighted PM_{2.5}, compared to Latvia 11.6 ($\mu\text{g}/\text{m}^3$), Lithuania 9.22 ($\mu\text{g}/\text{m}^3$) and Estonia 6.15 ($\mu\text{g}/\text{m}^3$). The same with the ambient ozone pollution, measured as the average seasonal population-weighted ozone, Moldova shows the highest level of pollution 38.1 (ppb), followed by Latvia (36.4 ppb), Estonia (35.9 ppb) and Lithuania (34.4 ppb). However, with regard to the household air pollution from solid fuels measured as the proportion of population using solid fuels, the ranking is different: Latvia (0.12), ranks first, followed by Estonia (0.09), Moldova (0.06) and Lithuania (0.03) (HEI, 2024). Regarding the quality and the availability of water, according to the baseline water stress, that measures the ratio between total water withdrawal and available renewable surface water supply, Moldova is in the medium-high (2-3) category as well as Lithuania, whereas Latvia falls into the low-medium (1-2) category and Estonia is in the low (0-1) risk category (World Resources Institute, 2023). As concerns the forest loss, the data for the analyzed countries are as it follows: in Moldova, a 3.8% decrease in tree cover was noted from 2000 to 2023. In Lithuania, a 18% decrease in tree cover has been attested since 2000, in Estonia - 22% and in Latvia – 26% respectively. With regard to the forest gain, from 2000 to 2020, Moldova gained 36.5 kha of the tree cover, equal to < 0.1% of the global total. Latvia gained a tree cover equal to 0.22% of the global total, Lithuania – an equal to 0.18% and Estonia an equal to 0.13% (Global Forest Watch, 2023).

In this research, however, the emphasis will be laid on the climate change issue as reflected in the amount of CO₂ emission, as an indicator of sustainability. It should be mentioned that the Baltic states joined the Climate Ambition Alliance: Net Zero 2050 that started in 2020, whereas Moldova is not yet part of this initiative. However, in 2024, Moldova made significant progress by passing a comprehensive climate action law, committing the country to achieving net-zero emissions by 2050 (see Law on climate actions, 2024).

From a different perspective, a sustainable economic growth is negatively affected by the climate change as it leads to precarious social and economic consequences, as for example global warming is said to have increased the global economic inequality between countries by about 25% over the last half century (Diffenbaugh *et al*, 2019, p. 9809). Moreover, a 2020 study carried out by the World Bank revealed that if no action is taken with regard to climate change, over 100 million people might end up in extreme poverty by 2030. And if the global CO₂ emissions are not reduced to zero the situation will become even worse after 2030. And again, the poorest regions are the ones that will suffer the most (Hallegatte *et al*, 2020). Thus, to address the climate change issue, the scientists revealed that the increase of the global temperature should not exceed and should be much below 2°C above pre-industrial levels. However, keeping the global warming to well below 2°C means to reduce the CO₂ emissions by 25-30% by 2030, and to get to net-zero by 2080. Thus, to make sure the objective is achieved, the target of 1.5°C warming should lead to net-zero emissions by 2050 (Pörtner *et al*, 2022, p.128).

In addition, it should be made clear that the inequality arises from the fact the GHG emitters are the ones that benefit from their activities, whereas the cost of the emissions is to be shared by everyone. Therefore, it becomes important to price the carbon so as to provide an incentive to reduce the emissions. The main instruments for carbon pricing are to apply a carbon tax or a GHG emissions trading system. Roughly speaking, the first one sets a tax on certain emission sources while the second established a limit on GHG emissions by particular sources (Haites, 2018, p. 956). The approach to carbon pricing should be gradual so as to start from lower taxes on products consumed by the poor population, such as kerosene and fair measures of revenue recycling, i.e. redistribution to protect vulnerable energy consumers, should be applied (Boulard *et al*, 2021, p.34).

The revenue measures should target the poor as they usually spend more on energy as compared to their income thus, affecting their purchasing power, and the loss should be compensated. Such measures could include means-tested direct transfers, in-kind transfers, pro-poor spending, or tax subsidies. A universal dividend might also be applied (Bhattacharya *et al*, 2021, p. 21). More specifically, with regard to recycling carbon tax revenue, we can note that due to consuming more, as richer households have larger houses, the rich households usually pay more than the poor ones.

However, as it turns out, relative to income the poor households pay more. Therefore, the inequality increases, because the poor household pays more tax relative to its income, and so has less after-tax income to spend. According to some authors, one way to fix this issue is by a social transfer introduced by the government to the poor households. Governments do not need to redistribute all carbon revenues to compensate poor and vulnerable groups. In some countries, less than 30% of carbon revenues transferred as cash to the poor would equalize the poorest two quintiles, and over 70% of carbon tax revenues could be used to cover other important issues (Vogt-Schilb *et al*, 2019, p. 2).

As well, the carbon taxation could be complemented with direct regulation of the GHG emissions or energy efficiency. Here as well the regulations and standards should include financial incentives or programs at the Government level for the poor to ensure compliance. And in the same order of ideas, the developed countries are strongly encouraged to allocate funds to financially motivate the developing countries to decrease their emissions (Dong *et al*, 2021, p.13). In the context of the analyzed countries, it should be mentioned though that by 2023, both Estonia and Latvia had increased their carbon tax rates. Estonia's carbon tax rose to €2 per metric ton of CO₂ (about \$2.18), and Latvia's to €15 per metric ton of CO₂ (about \$16.31) (Taxfoundation, 2023). Lithuania and Moldova, however, had not implemented carbon taxes. Lithuania relies on the EU Emissions Trading System (EU ETS) to price carbon emissions, while Moldova has not established a carbon pricing mechanism.

In the context of obtaining the status of an EU candidate country by the Republic of Moldova, and as a result of the need to fulfill certain conditionalities including related to the environmental ones, as well as the current situation described above, we consider it important to analyze what the position of the Republic of Moldova is in terms of income inequality, CO₂ emissions and growth compared to the Baltic states. This analysis should provide a first-step context of the current standing of the Republic of Moldova for further more complex research. It should be mentioned that the Baltic states have been selected as reference EU countries because they seem to be more comparable with the Republic of Moldova as the countries share a common past, even though one much allow for the quite large discrepancies in many respects among these countries.

Thus, the hypothesis of this research is that the Republic of Moldova is lagging behind the Baltic states in terms of inclusive and sustainable economic growth, even though the assumption is that the CO₂ emissions are lower than in the Baltic states due to lack of performant economic activity.

The novelty of the research resides in the fact that the situation of the Republic of Moldova in terms of income inequality, carbon inequality and growth is being analyzed, at the stage where the country has an EU accession candidate status and has started the negotiation process. The current status of the Republic of Moldova is analyzed in comparison with the Baltic states and the EU average in order to understand where the country is now and provide the basis for further steps and action. The methods used include description, analysis, synthesis and generalization of statistical data in the attempt to get an insight into the proposed assumptions. The research consists of an introduction that discusses the general context related to the analyzed topic, the literature review part, the research methodology, results, conclusions and references.

2. Literature review

In a range of researches, inequality has been analyzed as related to such phenomena as GHG /CO₂ emissions, growth, energy consumption and poverty at the country and at the international level. For instance, the historical evolution of weighted international inequality in CO₂ emissions attributed territorially and the global inequality in carbon footprints attributed to final consumers was analyzed by a team of researchers to answer the question of whether the scenarios of carbon emission redistribution are feasible for mitigating climate change as per the Paris Agreement and for reaching the sustainable development goal of eradicating poverty. One of the findings was that to implement the proposed scenarios the reduction in global inequality should be unprecedented. And a proposed solution is a fast decarbonization of the global energy supply so as to decrease global carbon emissions without relying much on carbon inequality reduction (Semieniuk *et al*, 2020).

As income inequality is assumed to be linked to energy consumption, CO₂ emissions, and growth, a number of researchers focused on analyzing the interrelation between these factors. A group of authors analyzed the correlation between the CO₂ emissions, energy consumption, income inequality,

and poverty within the framework of the Environmental Kuznets Curve (EKC). The results of the study showed that the correlation between income inequality, poverty, and energy consumption and the CO₂ emission differs depending on whether a country is a developed or a developing one. Specifically, in the developed countries no significant correlation was attested whereas in the developing countries the results have revealed that income inequality, poverty, and energy consumption positively affect the CO₂ emission. The research also proved the EKC hypothesis, in line with which the relationship between per capita income and CO₂ emissions has an inverted U-shape in the developed countries but it was not validated in the case of the developing countries (Akbas *et al*, 2021, p.7).

A U-shape relationship has also been attested between GDP per capita and the GHG emission per capita in a research in which the link between income inequality and consumption-based GHG emission per capita was analyzed by applying the country-level data for 1990–2014. The researchers argue that due to the prevailing economic structures, the relationships between the aforementioned phenomena is non-linear and confirm the existence of a U-shape relationship between GDP per capita and the GHG emission per capita. Moreover, the research shows that the poorest countries experience the highest effect of the inequality on GHG emission (Baležentis *et al*, 2020). Whether the renewable energy might be affecting income inequality was considered in a study that aimed at investigating the impact of renewable energy consumption on income inequality in a panel group of developed economies over the period of 1990–2014. The outcome of the study is that an increase in renewable energy consumption leads to a decrease in income inequality. The study has shown a double effect of renewable energy sources use tackling on the one hand some of the environmental issues and contributing, on the other hand to the reduction of income inequality (Topcu *et al*, 2020). Moreover, another study focused on analyzing the different contributions of various income groups to carbon emissions in a period of 25 years. Using new data on global and national income inequality, combined with national consumption emissions over the mentioned period the researchers related the emissions to income levels for the populations of 117 countries. The study also puts forward scenarios of carbon inequality based on different possible trajectories of economic growth and carbon emissions (Kartha *et al*, 2020).

At the same time the impact of income inequality on CO₂ emissions was analyzed in a thesis where the author has tried to understand if by reducing the income inequality the per capita CO₂ emissions would actually increase. Using a grouped fixed effects estimator, the relationship between the two phenomena in a two-way error component model was analyzed. As a result, it has been found that the impact of income inequality on CO₂ emissions depends on the level of income, i.e. if the income is below a certain threshold and the income inequality is reduced, this brings about an increase in CO₂ emissions, while on the other hand, if the income is above that threshold it leads to an opposite result (Granser, 2021). Affirming that not all the human beings contribute equally to climate change, Chancel (2022), estimated the global inequality of individual greenhouse gas emissions based on data on income and wealth inequality, environmental input-output tables and a framework that separates the emissions from consumption and those from investments. The conclusion is that in 2019, the bottom 50% of the world population emitted 12% of global emissions while the top 10% emitted 48% of the total. A significant difference in emissions has been revealed between the bottom 50% of the world population and the top 1%. Furthermore, the study has revealed that the total emissions from the global top 1% of the world population results from their investments and not as much from their consumption (Chancel, 2022).

Nevertheless, based on a study that shows that in high-income countries a huge increase in economic inequality has been attested over the past 30–40 years, the impact of “extreme wealth and precarious poverty” should be considered on energy consumption, access to energy services and also on CO₂ emissions (Galvin *et al*, 2018). It is interesting to note that some researchers, have argued that climate change affects inequalities between countries in two ways: the rising temperatures from greenhouse gas accumulation has a more detrimental effect on the low-income countries and at the same time the high costs of climate change mitigation by reducing emissions is likely to make the poor countries lag behind the developed countries from the economic point of view. Based on these assumptions, the researchers have tried to come up with scenarios that showed the joint effects of the mitigation costs and climate damages on inequality.

The results proved that the uncertainties related to socioeconomic assumptions and damage estimates are the main drivers of future inequalities (Taconet *et al*, 2020).

Other authors sensed the existence of a correlation between the well-being, which among other dimensions includes the environmental component, and the income inequality. In a study carried out across several Central Eastern European countries after joining the European Union in 2004, the researchers managed to identify the canals through which income inequalities linked either directly or indirectly with certain dimensions of well-being, showing that on long term income inequalities are impacted by the well-being status, including the dimension related to the natural environment. The research also revealed a decreasing trend of the CO₂ emissions per capita in all CEE countries except for Poland, Latvia, and Lithuania and that the levels of CO₂ emissions per capita are very heterogeneous among the CEE countries (Szczepaniak *et al*, 2021).

3. Research methodology

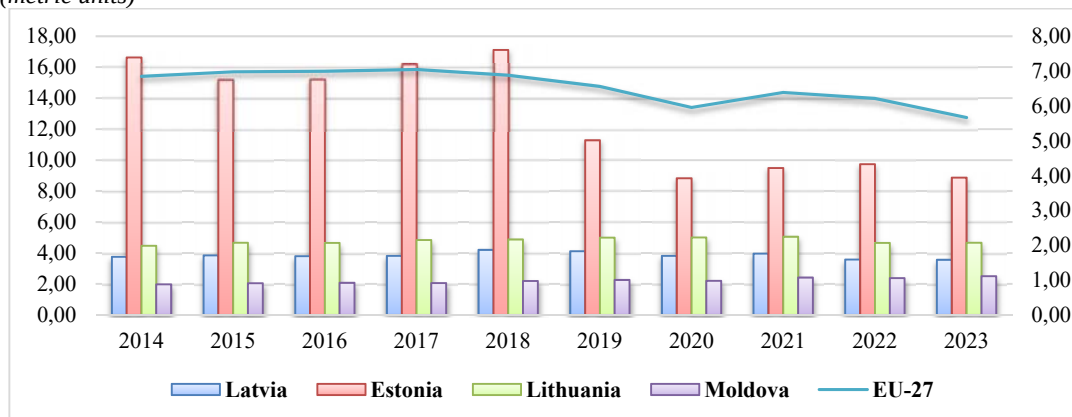
In order to present the picture of the situation in the Republic of Moldova and in the Baltic states, data on fossil CO₂ emissions were retrieved, including the data on carbon inequality, by presenting a comparison between the top 10% carbon emitters in all the analyzed countries, as well as on income inequality (GINI coefficient and top 10% national income share, as these two indicators capture different perspectives) and on the GDP/PPP as an indicator of growth. The selection of these indicators is based on the attempt to understand where the Republic of Moldova ranks in terms of inequality, sustainability and growth as compared to the Baltic states and the EU average. The data used in this research have been retrieved from EDGAR emission database for fossil CO₂ emissions, the World Bank Database for GDP/PPP, the National Bureau of Statistics for the GINI coefficient for the Republic of Moldova and EUROSTAT for the Baltic States and EU-27 average, and the World Inequality Database for the top 10% national income share and the top 10% average personal carbon footprint.

Thus, the position of the Republic of Moldova in terms of economic growth (GDP/PPP as an indicator), income inequality (two indicators - GINI and the top 10% national income share) and climate change (Fossil CO₂ emissions per capita as a direct indicator of human-produced greenhouse gas) was compared to the Baltic states and the EU average. The carbon inequality, in particular, was analyzed based on the data on the top 10% carbon emitters for each Baltic state and the Republic of Moldova. The data from 2014 to 2023 were analyzed for CO₂ emissions, GDP/PP and Gini, to reflect a year 2014 before the signing of the Paris Agreement in 2015, as a starting point, and to the most recent available data. For top 10% income share and top 10% carbon emitters, the period from 2001-2020/2021 was selected to follow the dynamic for a longer period.

4. Findings

The data for the analyzed years presented below (Figure 1) show a large discrepancy in terms of fossil CO₂ emissions per capita in the Baltic states. Estonia has consistently exhibited the highest emissions, significantly exceeding those of the other Baltic states and the EU average throughout the analyzed period. Although Estonia's emissions showed a descending trend from 2018 to 2020, they increased in 2021 (9.49) compared to 2020 (8.83) with a slight increase in 2022 (9.74) and a decrease in 2023 (8.87). Despite this slight decrease in 2023, Estonia's emissions remained dramatically higher than the EU average. Lithuania's CO₂ emissions have changed only mildly during the analyzed period. The country reached its peak emissions in 2021 (5.05) with a slight increase compared to 2020 (5.00). However, emissions decreased a bit in 2022 and 2023, staying below the EU average. Latvia displayed uneven changes in CO₂ emissions during 2014–2023, peaking in 2018 (4.20) and taking a descending trend since then. The Republic of Moldova consistently emitted the least CO₂ per capita during the analyzed period compared to the Baltic states. However, its emissions increased steadily, reaching a level of 2.50 in 2022. Moldova's emissions have remained well below the EU average throughout the analyzed period. Notably, as of 2023 all the analyzed countries emitted less than the EU average, which declined from 6.85 in 2014 to 5.66 in 2023. Thus, Estonia's emissions remain a notable outlier.

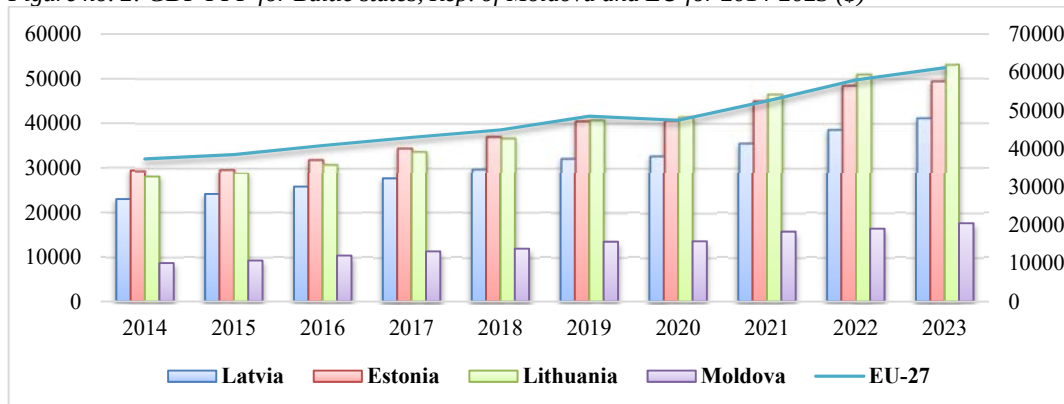
Figure no. 1: Fossil CO₂ per capita emissions in Baltic states, Rep. of Moldova and EU-27 for 2014-2023 (metric units)



Source: EDGAR Community GHG Database (a collaboration between the European Commission, Joint Research Centre (JRC), the International Energy Agency (IEA), and comprising IEA-EDGAR CO₂, EDGAR CH₄, EDGAR N₂O, EDGAR F-GASES version EDGAR_2024_GHG (2024) European Commission. https://edgar.jrc.ec.europa.eu/report_2024

With regard to GDP/PPP, all the analyzed countries followed a generally increasing trend from 2014 to 2019, with a notable decline in 2020 due to the global economic impact of the COVID-19 pandemic. This was followed by a recovery in 2021, when GDP/PPP exceeded the 2019 levels. The growth trend continued through 2022 and 2023 for all countries. When comparing GDP/PPP levels to the EU average, it remains evident that none of the analyzed countries have reached or come close to the EU-27 average during the analyzed period. Lithuania and Estonia consistently recorded the highest GDP/PPP among the analyzed countries, with Lithuania reaching \$53,184.8 dollars in 2023 and Estonia with \$49,500.7 dollars. Latvia followed, with its GDP/PPP growing to \$41,251.8 dollars in 2023. Moldova, as expected, presented the lowest GDP/PPP, reaching only \$17,596.9 dollars in 2023—less than half of Latvia's GDP/PPP, which remains the lowest among the Baltic states. Despite steady growth across the period, the GDP/PPP levels of the Baltic states and Moldova highlight significant economic disparities compared to the EU average, which increased from \$37,327.1 dollars in 2014 to \$61,217.6 dollars in 2023 (Figure 2).

Figure no. 2: GDP PPP for Baltic states, Rep. of Moldova and EU for 2014-2023 (\$)

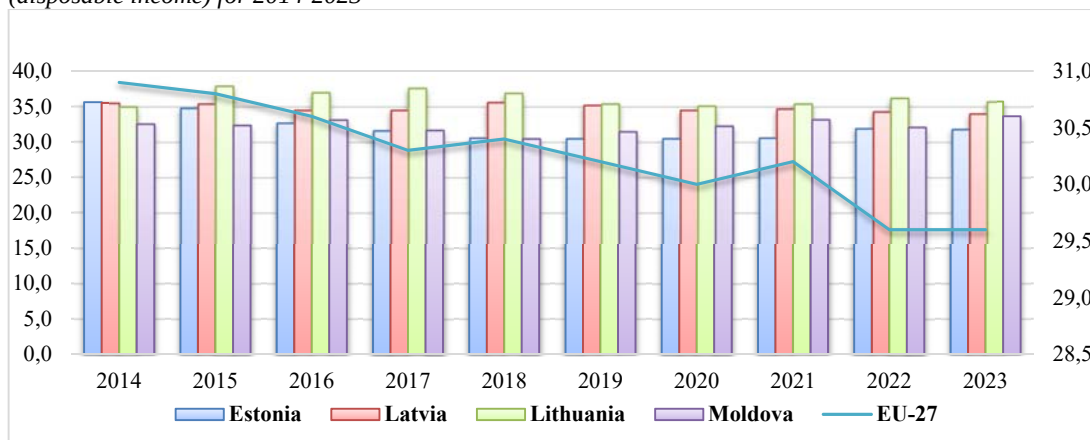


Source: World Bank, <https://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD?locations=MD-LT-LV-EE-EU>

Another interesting observation is that income inequality, expressed by the GINI coefficient, continues to exceed the EU average in all the analyzed countries. Estonia has shown a decreasing trend since 2014, with the GINI coefficient declining steadily from 35.6 in 2014 to 31.8 in 2023. Between 2018 and 2021, the GINI coefficient stabilized around 30.5–30.6 but has slightly increased since 2021. Lithuania consistently exhibited the highest GINI coefficient since 2015, peaking at 37.9

in 2015 and ending at 35.7 in 2023. Latvia follows closely, with fluctuations between 35.5 in 2014 and 34.0 in 2023. Meanwhile, Moldova showed varying trends throughout the analyzed period, reaching 33.6 in 2023. The EU-27 average GINI coefficient is on a descending trend, down to 29.6 in 2023, highlighting the consistent disparity in income inequality between the analyzed countries and the EU average since 2017. (Figure 3).

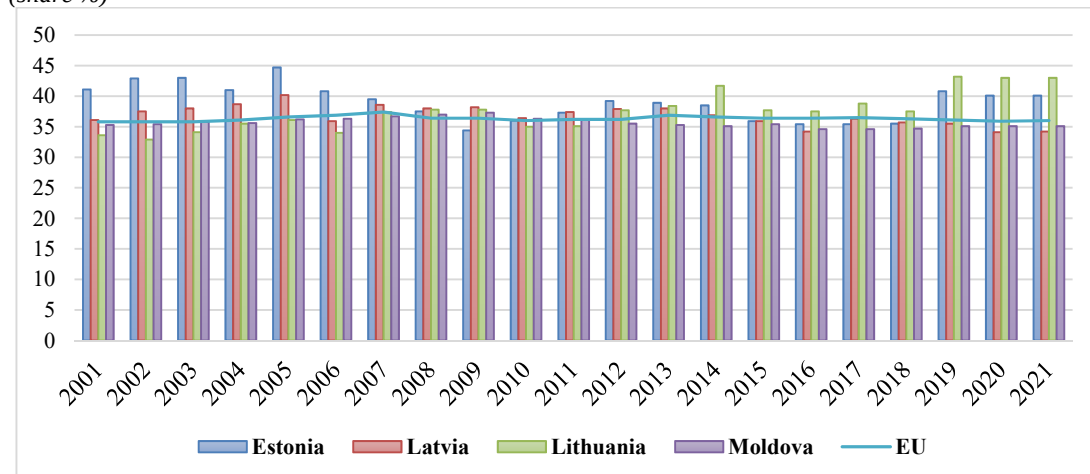
Figure no. 3: GINI for Baltic states and EU (equivalized disposable income) and Rep. of Moldova (disposable income) for 2014-2023



Source: EUROSTAT <https://ec.europa.eu/eurostat/databrowser/view/tessi190/default/bar?lang=en>, NBS <https://statistica.gov.md/index.php/en?l=en>

In the context of the sustainable economic growth – income inequality nexus, it is worth analyzing the top 10% national income share (considered to be the layer of the highest CO2 emitters (Gore, 2020)). The data presented in the diagram below for a period of 21 years (Figure 4), show the lowest 10% share of national income in 2021 in Latvia (34.2%) followed by the Rep. of Moldova (35.1%), both ranking below the EU average (36%). Lithuania (43%) and Estonia (40.1%) show the highest top 10% national income share and rank much above the EU average. It should be mentioned though that the top 10% share in Estonia was much lower during 2019-2021, than in 2005 (44.7%). In Lithuania and Estonia, a significant increase occurred after 2018 and stayed relatively at the same enhanced level between 2019-2021 (in Lithuania between 43 and 43.2 % and in Estonia - between 40.1 and 40.8 %). In Moldova, a slight increase occurred after 2018 and stayed at the same level until 2021 (35.1%).

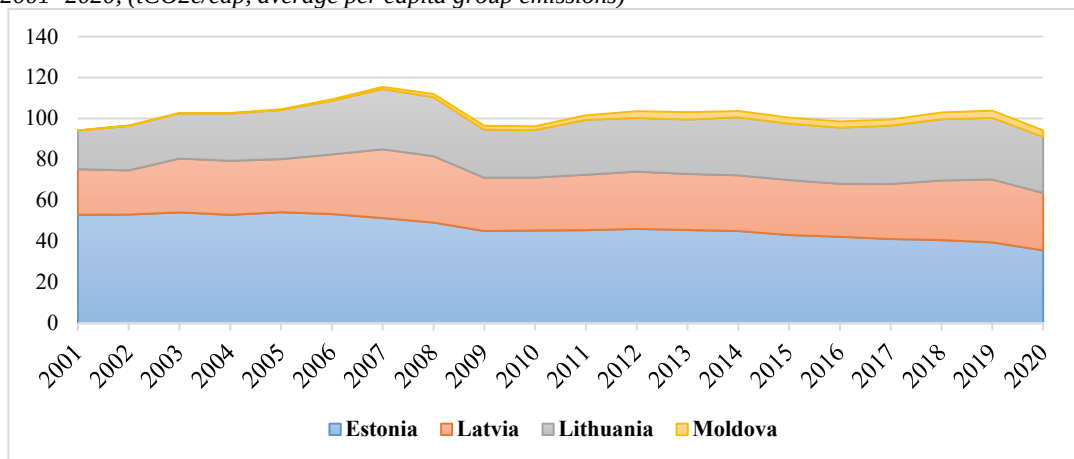
Figure no. 4: Top 10% national income share, Baltic states, EU and Rep. of Moldova for 2001-2021 (share %)



Source: WID <https://wid.world/data/>

The trend of carbon inequality is presented in the diagram below. According to the data, for 21 years (2001-2020), Estonia, even though it presents a decrease in CO₂ emissions of the top 10%, still shows the highest level of emissions (36 tCO₂e/cap) in 2020 followed by Latvia and Lithuania which reach the same level of emissions (28 tCO₂e/cap) in 2020. The Republic of Moldova, even though showing a significant increase in the emissions of the top 10% since 2001 (compare: 0.1 tCO₂e/cap in 2001 and 3.1 tCO₂e/cap in 2020), presents much lower emissions than the Baltic states that have the lowest level of the top 10% emitters. As for the trend, in 2020 all the countries show a decrease in the emissions of top 10% compared to 2018 and 2019, even though except for Estonia, the level of top 10% emitters increase compared to 2001, the beginning of the analyzed period (Figure 5).

Figure no. 5: Top 10% average personal carbon footprint (all sectors), Baltic states and Rep. of Moldova 2001- 2020, (tCO₂e/cap, average per capita group emissions)



Source: WID <https://wid.world/data/>

5. Conclusions

The analysis reveals significant disparities in fossil CO₂ emissions, economic performance, and income distribution across the Baltic states and Moldova. Estonia stands out as an outlier with persistently high per capita CO₂ emissions, despite recent reductions. In contrast, Latvia and Lithuania have maintained more stable emissions, while Moldova, given its economic limitations, shows a comparatively low but steadily rising carbon footprint. Even though there has been economic growth across all countries, particularly after the pandemic, none have reached the EU-27 average GDP/PPP, with Moldova remaining far behind. Income inequality persists, with GINI coefficients consistently above the EU average, particularly in Lithuania. The top 10% of earners in the Baltic states hold a disproportionate share of national income and contribute significantly to CO₂ emissions.

Thus, the preliminary descriptive analysis indicates that the Baltic states and Moldova must address these disparities through targeted policies. Estonia's focus should be on further diversifying its energy sources and implementing carbon pricing mechanisms, while Lithuania and Latvia should enhance social redistribution measures to reduce inequality. Moldova's development strategy should prioritize green investments and economic diversification to foster equitable, low-carbon growth. EU support, in the form of cohesion funds and green transition assistance, could be used once available, to bridge the economic and environmental gaps.

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The New Challenges of Artificial Intelligence in Digital Transformation and Economic Competitiveness

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Abstract

The recent adoption of the European Union Law on Artificial Intelligence (AI) in 2024 has created a regulatory framework that aims to balance innovation and ethical governance for the advancement of AI in the EU. Responsible adoption of AI without sacrificing the competitiveness of SMEs requires flexible legal frameworks and systems that support the growth of startups and cooperative activities. SMEs' business operations are more significantly affected by digital transformation and the adoption of AI-based technologies. Thus, innovation, new value creation and dynamic capabilities are the main themes of previous research on digital transformation and SMEs. The paper comparatively analyzes the impact of the new EU regulation on AI on SMEs: Romania versus the EU. The paper includes also the possible long-term effects of the AI Law on European SMEs and identify future research directions.

Key words: digital transformation; innovation; competitiveness; AI regulation; economic competitiveness

J.E.L. classification: O33, O42, C33, L86

1. Introduction

AI implementation is slower in European SMEs than in large corporations. Based on Eurostat data from 2024, 11% of EU SMEs claim to leverage AI technologies, while more than 41% of larger companies do. This difference illustrates some challenges at the core which include the lack of technology and digital competence, as well as the compliance burden brought by the AI Act.

Digital transformation contributes to improving efficiency, innovation, and customer interaction. As the adoption of digital strategies becomes critical for businesses to remain competitive on the European market, digitalization has been placed at the center of the economic agenda which aims to develop a viable and internationally competitive Digital Single Market.

SMEs have limited access to infrastructure and skilled labor, as they lack the technological resources to integrate AI at scale, relying on third-party vendors or off-the-shelf solutions. The AI skills gap is a major obstacle – over 34% of SMEs believe that a lack of skilled personnel is preventing them from adopting AI (The 2024 AI Index Report, 2024). At the same time, competition for AI specialists is fierce, and SMEs struggle to compete with large companies for talent. EU AI market is highly fragmented, and SMEs face difficulties accessing international markets due to different regulatory standards. While SMEs in the US and China operate in a more flexible framework, European SMEs must navigate a complex regulatory landscape, which reduces the ability to scale and expand internationally.

With the right smart technologies implemented in AI especially-SMEs have a variety of opportunities in sight (at least that is what there should be, however). Regulatory compliance design is possible. One of the primary advantages of SMEs adopting AI is in terms of operational efficiencies and productivity. With machine learning, we can take the monotonous tasks out of the

way and operate automatic supply chains that reduce costs while providing data-driven decisions to your organization (World Bank ,2022)

AI adoption is linked with an increase in revenue growth for companies. The longer investment in AI, companies have grown, the higher their sales and workforce in all industries we examined. Using AI increases product innovation, e.g., with new AI-based functions or enhanced existing ones, and so contributes to the product portfolio and market penetration. This could also be vital for the smallest businesses as it allows them an opportunity to battle the larger competitors through innovation.

Digital transformation programs at the EU level: Some financial and programmatic assistance is available to European SMEs through digital initiatives. The EU has acknowledged that small businesses need support on their AI adoption journey and is providing resources through Digital Europe, Horizon Europe, or the Innovation Network to reinforce the role of the Digital Lighthouse (DL). Such is the case of European Digital Innovation Hubs (EDIH) digital hubs built to connect companies with the latest technological tools and training.

There is a huge opportunity to move towards ethical, lawful AI that can be positioned as one of those silver pluses. SMEs that embrace early the demands of the AI Act (transparency in algorithms and ensured safety & fairness) will foster good credibility and customer orientation towards their products or services.

The paper examines the impact of the "EU AI Act" on the competitiveness of SMEs at EU level. The authors highlight three possible scenarios based on the recent AI regulation and how the responsible adoption of AI will contribute to increasing the competitiveness of European enterprises in the future.

The paper is structured as follows: an introduction, the second section presents the theoretical background, the third section presents the research methodology, and the fourth section of Findings. The paper ends with a section on Conclusions.

2. Theoretical background regarding "EU AI act"

The EU has adopted a proactive approach to technology regulation, with the main objective of creating a safe, competitive and innovative digital environment that protects citizens' fundamental rights and supports economic development. In contrast to other regions, such as the United States, which favors a more flexible regulatory framework based on self-regulation, or China, which implements strict oversight of digital technologies.

The most significant challenges are those pertaining to the cost of compliance and regulatory impediments, insufficient access to the requisite infrastructure and skilled personnel, as well as fragmentation of markets and hurdles to scale up. The first comprehensive regulation of AI, known as The AI Act, has set a brand-new standard for legislation on the ethical and safe use of AI technologies; however, SMEs still find regulations to be a barrier due to a few factors: for high-risk AI projects, operational compliance costs increased by over 17% (e.g., those related to auditing algorithms and producing technical documentation (EU, 2021); failure to comply with these compliance regulations can lead to fines of up to 7% of global revenues or €35 million (EU, 2024); the controls imposed by the Artificial Intelligence Act can extend the time needed to bring an AI product to market, affecting the competitiveness of startups and SMEs in regulated industries such as medicine or finance (EU, 2024).

Artificial Intelligence (AI) automates and enhancing process performance and cost optimization across industries. Through AI adoption, companies enhance productivity and develop cutting-edge strategies and techniques to remain competitive (Wamba-Taguimdje et al.,2020). Implementing AI into the social sphere brings privacy concerns, algorithmic discrimination, and effects on employment (Liu et al., 2020).

Analysis the compliance with AI regulation can improve market credibility and consumer confidence on a brand that is known for ethical playing and ultimately calling in means: partnerships, investment. Further, the compliance of the AI Act provides long-term predictability to the business, as by law, certain provisions get settled and, therefore, mitigate prospective sanctions for the years ahead. In the present time, when average consumers and business partners are paying closer attention to manners and non-sensitive data is processed (particularly when it comes to AI

and non-discrimination), regulation compliance is a competitive advantage. European SMEs drive high norms, taking advantage of the emerging international norms as they should be able to operate in a broader swath of foreign markets where similar data protection laws are adopted.

AI as a Service (AIS) lets the SMEs leverage AI solutions using cloud computing without having to splurge in a vast upfront investment on having physical hardware or specialist in-house skills. A different inventive method is AI crowdsourcing for SMEs, whereby collaboratively they could work on a common solution to AI problems at a reduced cost and speed innovation (Howe, 2006). The method is already widely used in high-growth industries like data analytics and cyber security, where developer communities construct and improve AI models.

SMEs should take a more proactive approach to complying and innovating based on the challenges arising from AI Act. One of the solutions that AI Act is putting forward is sanitation sandboxes - these laboratories test AI solutions within a safe legal framework afforded SMEs so they can check if theories will work, lowering commercial and legal risks. To adapt AI sustainably, SMEs must invest and acquire knowledge to apply digital training programs (Brunetti et al., 2020). Next, cooperation in European AI networks is a must: cross-border partnerships allow the exchange of experiences, reduce implementation costs, and foster common standards for responsible innovation.

To foster the responsible growth of AI, in 2024, the European Union passed Regulation EU 2024/1689, the "EU AI Act" (EU, 2024). Monitoring the effects of this regulation on SMEs is crucial as the new standards about compliance, transparency, and AI risk management can affect the companies' competitiveness, innovation, and operational costs. This will determine whether adaptive measures at the EU level are needed so that European companies can harness the most benefits while facing the least constraints from the new regulation.

The EU AI Act" sets rules for each stage of AI creation, imposing the most stringent obligation on high-risk AI systems, which complicates the tasks of SMEs and AI start-ups (OECD, 2023). The newly established EU Artificial Intelligence Regulation in 2024 and the anticipated phased enforcement over the subsequent two years has necessitated the evaluation of its potential impacts on the adoption, governance, and overall ecosystem of AI. The literature reflects the need for appropriate regulations for the responsible use of these disruptive technologies (Romero et al., 2020). However, the new regulation could also create significant problems for businesses with limited financial and technical resources, as the cost and complexity of compliance could limit their capacity to innovate (Rana et al., 2022).

Therefore, an effective regulatory framework must create an environment that supports both sustainable growth and technological progress, allowing European innovators to remain relevant in a dynamic and competitive technological landscape (Bradford, 2023).

Artificial Intelligence (AI) has evolved significantly, going through several stages of development since the 1980s: machine learning (systems that improve their performance by analyzing historical data), deep learning (machine learning models inspired by the neural networks of the human brain), and, more recently, generative AI, deep learning models that create original content (Paul, Criado, 2020).

The European Union has positioned itself as a global leader in promoting trustworthy, human-centric artificial intelligence, a vision consolidated since the 2018 AI Strategy (EU, 2018) and fleshed out through the EU AI Act in 2024 (EU, 2024). The EU AI Regulation (EU AI Act) classifying AI systems into four categories (EU, 2024):

- *unacceptable risk*: Artificial Intelligence (AI) used in manipulative practices or for social scoring, prohibited due to its negative impact on society.
- *high risk*: Artificial Intelligence (AI) used in critical infrastructure, health, employment, data transparency and human oversight, cybersecurity.
- *limited risk*: Artificial Intelligence (AI) in chatbots or deepfakes, which require transparency obligations.
- *minimal risk*: Artificial Intelligence (AI) in spam filters or video games, which does not require specific regulation.

This framework is considered by the EU institutions to be adequate to address the specific risks of AI, while promoting a safe and competitive AI ecosystem. This issue is particularly important due to the AI Act's consequences for job and value creation in Europe's SMEs and startups

(OECD, 2023). The EU promotes ethical and responsible innovation while ensuring the protection of its citizens and sustainable digital progress through the creation of a trustworthy AI environment (EU, 2018; EU, 2024).

Table 1 provides an overview of the technology legislation with an impact on the Digital Single Market, adopted or in the process of being adopted at EU level.

Table no. 1 EU digital technology regulations

Name of regulation	Year of adoption	Main objective
Electronic Identification Regulation (eIDAS)	2014	Establishes a framework for electronic identification and trust services in the European Union
General Data Protection Regulation (GDPR)	2016	Personal data protection and user privacy
Cybersecurity Regulation	2019	Establishing cybersecurity certification frameworks at EU level.
Data Governance Act	2022	Facilitating data management and sharing at European level
Digital Services Act (DSA)	2022	Creating safer online environments and combating illegal content.
Digital Markets Act (DMA)	2022	Regulating large digital platforms to prevent anti-competitive practices
Directive on Security of Network and Information Systems (NIS 2)	2022	Strengthening cybersecurity for critical infrastructure.
Data Act	2023	Regulating access to and use of industrial and commercial data
Cyber Resilience Act	2024	Increasing cybersecurity for digital products and services
European Digital Identity Regulation (EUDI)	2024	Creating a unified digital identification system for citizens and companies
Artificial Intelligence Regulation (AI Act)	2024	Establishing an ethical framework for the responsible development of Artificial Intelligence

Source: own processing, based on <https://eur-lex.europa.eu/>

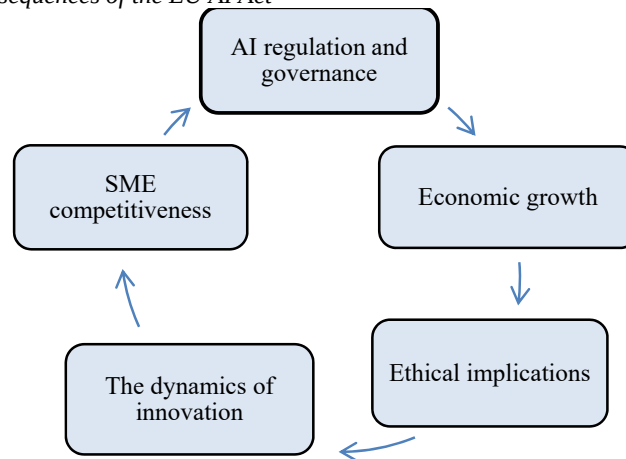
From Table 1 these regulations address a wide range of issues, from electronic identification and personal data protection to cybersecurity and the responsible use of artificial intelligence. The Artificial Intelligence Regulation (AI Act) establishes an ethical framework for the responsible development of artificial intelligence, regulating AI systems according to their level of risk. It also prohibits high-risk AI applications, such as social assessment or the use of biometrics, requires transparency for generative AI, and requires compliance assessments for critical sectors (AI Act, 2024).

3. Research methodology

The main barrier to the realization of the New EU AI Regulation is the existence of some form of measurement of the emerging benefits that might go towards encouraging responsible innovation and adoption of AI, as well as the negative impacts emerging from the New EU AI Regulation's implementation constraints on the competitiveness of European firms relative to their counterparts from less regulated economies (Acemoglu & Restrepo, 2020).

Figure 1 presents the main consequences of the EU AI Law from a business model perspective.

Figure no. 1 The consequences of the EU AI Act



Source: own processing

Figure 1 shows how these issues are interconnected and highlights the multifaceted approach that needs to be taken when examining the consequences of the EU AI Act from a business model perspective. AI has the potential to enhance operational productivity by automating tasks and decreasing expenditure. However, compliance with the AI Act may entail certain administrative costs and restraints, particularly for smaller firms.

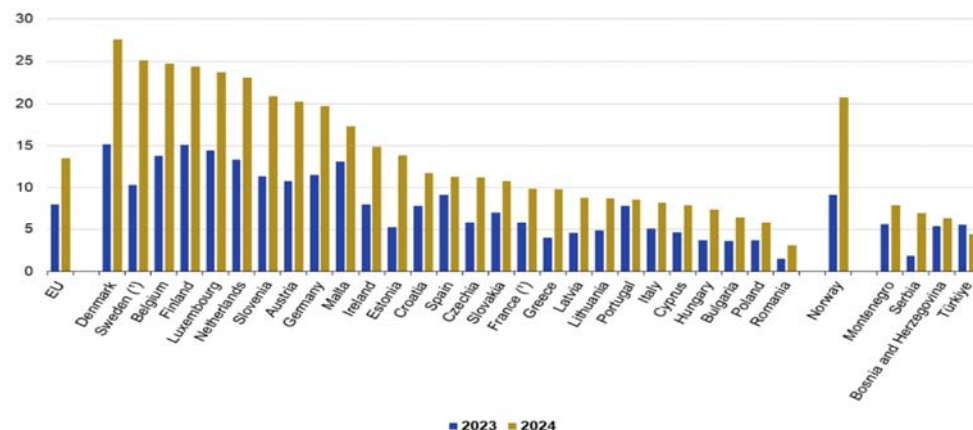
4. Findings

Artificial intelligence (AI) is increasingly recognized as a transformative technology for businesses across all sectors. Using data provided by Eurostat, the analysis highlights adoption rates by company size, sector and country, explores the main applications of AI and discusses the main challenges for large-scale deployment. The findings indicate a significant increase in AI adoption across the EU but reveal persistent regional and sectoral disparities that pose challenges to inclusive digital transformation.

Figure 2 shows that the adoption of artificial intelligence (AI) technologies by enterprises increased between 2023 and 2024 in Europe.

Figure no.2 Enterprises using AI technologies (2023 - 2024(% of enterprises)

Enterprises using AI technologies, 2023 and 2024
(% of enterprises)



(*) 2023: Break in the time series.

Source: Eurostat (online data code: isoc_eb_ai)

Source: Eurostat

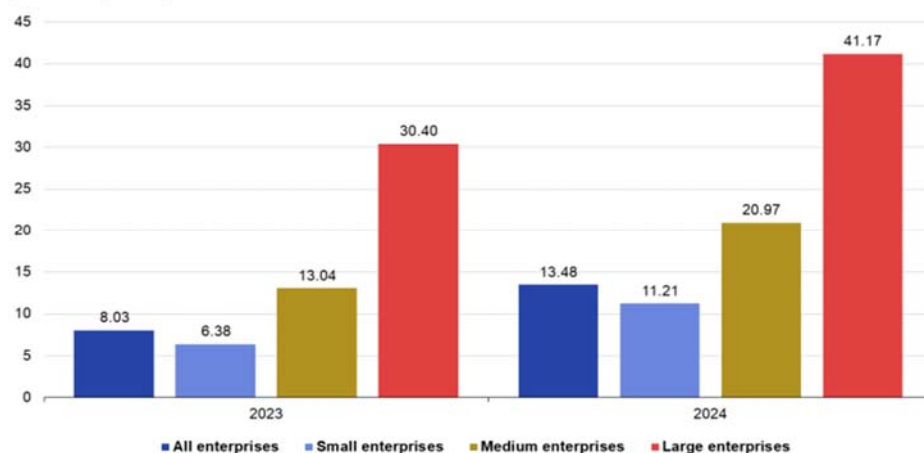
eurostat

Regarding adoption rates, according to Figure 2, they varied considerably between EU Member States. This regional variation reflects disparities in digital infrastructure, investment capacity and workforce skills across the EU. It is observed that low adoption of AI persists in countries such as Romania, Poland, Bulgaria and Turkey.

Figure 3 shows the percentage of EU enterprises using AI technologies in 2023 and 2024, broken down by enterprise size.

Figure no. 3 Enterprises using AI technologies by size class, EU (2023 – 2024) % of enterprises

Enterprises using AI technologies by size class, EU, 2023 and 2024
(% of enterprises)



Source: Eurostat (online data code: isoc_eb_ai)

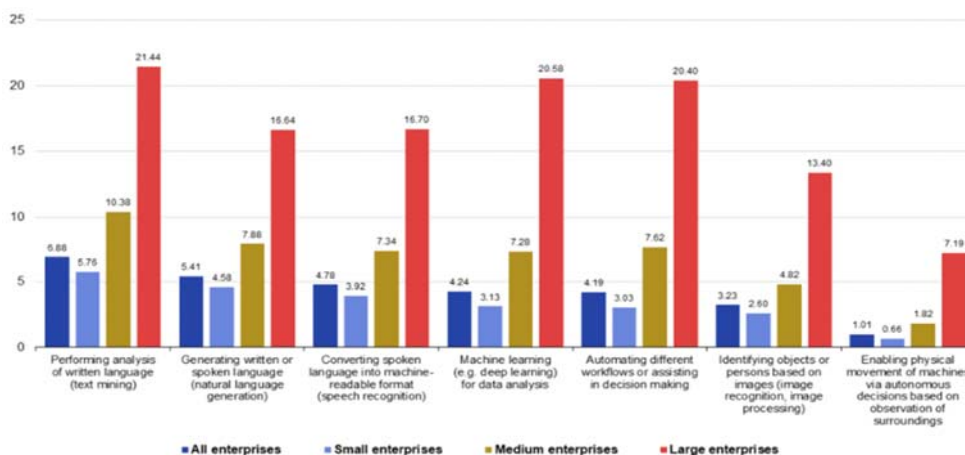
eurostat

Source: Eurostat

Figure 3 shows that all enterprise categories increased their use of AI technologies from 2023 to 2024. Thus, Small enterprises increased from 6.38% in 2023 to 11.21% in 2024, Medium-sized enterprises increased from 13.04% to 20.97%, Large enterprises increased from 30.40% in 2023 to 41.17% in 2024.

Figure 4 shows that in 2024, the use of AI technology among EU enterprises varied significantly by both the type of AI application and the size of the enterprise.

Figure no. 4 Enterprises using AI technologies by type of AI technology and size class, EU, 2024 (% of enterprises)

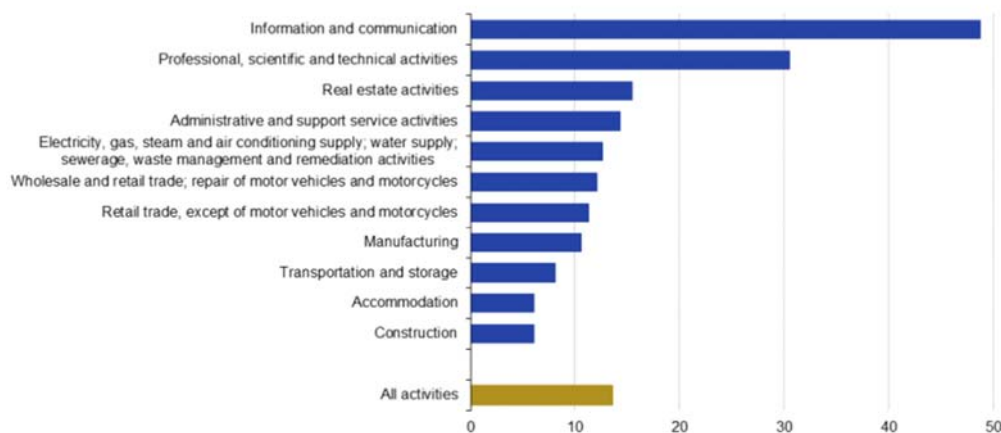


Source: Eurostat

Figure 4 illustrates that large enterprises have the highest adoption rates across all categories, particularly for text mining (21.4%), machine learning for data analytics (20.6%), and workflow automation (20.4%). In contrast, small and medium-sized enterprises (SMEs) have seen much lower adoption, typically below 8% across all types of AI. Across all enterprises, the most common uses of AI performed written language analysis and applied machine learning to data analytics, while enabling physical movement of machines through autonomous decisions (robotics) remained the least adopted technology. This highlights both the technological leadership of large companies and the continuing gap in AI implementation among smaller firms. Figure 5 shows that in 2024, the adoption of AI in EU enterprises varied significantly by economic sector.

Figure no. 5 Enterprises using AI technologies by economic activity, EU, 2024/(% of enterprises)/

Enterprises using AI technologies by economic activity, EU, 2024
(% of enterprises)



Source: Eurostat (online data code: isoc_eb_ain2)

eurostat

Source: Eurostat

From figure 5 the highest adoption rates are recorded in the information and communications sector, where almost half of the enterprises had integrated artificial intelligence technologies. This was followed by professional, scientific, and technical activities, with around a third of companies using AI, while sectors such as real estate and administrative and support services also recorded moderate adoption. In contrast, traditional industries such as construction and transport recorded the lowest adoption rates of AI, remaining well below the EU average of around 13%. This pattern highlights a strong digital divide between technology-based sectors and more traditional industries, suggesting that AI deployment is still heavily concentrated in knowledge-based and digital-first areas. In conclusion, the period 2023-2024 saw significant progress in the adoption of AI technologies among EU businesses, although disparities remain evident. Future efforts need to focus on reducing the gaps between large and small businesses and between Member States to ensure that the benefits of AI are distributed fairly across the Union.

5. Conclusions

The European economy largely relies on the contribution of Small and Medium-sized Enterprises (SMEs), as they are flexible and have significant innovative potential in terms of AI technologies. However, SMEs face obstacles in terms of adopting digital technology and navigating the rapid pace of change in business in general. Artificial Intelligence (AI) focuses on redesigning systems. AI is a range of technologies that include machine learning (deep learning), artificial neural networks (ANN) or natural language processing (NLP)/cognitive robotics. It is becoming the most essential technology in various niches such as healthcare, education or business

(for example), cybersecurity and social sciences. The rapid changes in the field of AI require a broad understanding both to minimize risks and to identify potential opportunities.

This paper further investigated the commercial and competitive aspects of the EU Artificial Intelligence Law from the perspective of SMEs in the Digital Single Market. Responsible and strategic use of AI will be the competitive advantage for SMEs adopting AI in the coming period. In addition, the necessary financial support from the European Union (funding, digital education, regulatory skills) will be beneficial for SMEs in implementing innovative AI models and in compliance with European regulations to turn AI into a growth driver and competitive differentiator.

In conclusion, SMEs in Europe have huge opportunities in the field of AI, but their companies depend on navigating AI legislation and correctly incorporating AI technology. While compliance hurdles and lack of resources will be important barriers, there are innovative ways out and international cooperation could transform the role of SMEs as drivers of AI-driven economic development. As future research directions, we propose expanding the analysis through qualitative research based on a questionnaire to be completed by SMEs in Romania regarding the effects of the new AI law on competitiveness in different sectors of activity.

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Social Economy Initiatives in the Romanian Orthodox Church: An Analysis of its Contribution to Community Development and Social Welfare

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Abstract

The social economy has gained increasing recognition globally and at the European level as a distinct sector, situated between the traditional market and the public sector, with the primary aim of generating positive social impact rather than maximizing profit. This paper aims to explore the social economy initiatives undertaken by the Romanian Orthodox Church, analyzing how they align with social economy principles and contribute to community development and social welfare in Romania. Through qualitative research methods, the study analyzes how this representative institution implements principles of social economy within various charitable and social projects. The findings highlight the Romanian Orthodox Church's strategic use of economic solidarity, cooperative practices, and social entrepreneurship to promote sustainable community development and social inclusion in Romania.

Keywords: social economy, social welfare, Romanian Orthodox Church

J.E.L. classification: I31, L31, Z12

1. Introduction

The social economy has gained increasing recognition globally and at the European level as a distinct sector, situated between the traditional market and the public sector, with the primary aim of generating positive social impact rather than maximizing profit (Monzón *et al*, 2008; Noya *et al*, 2007). In the age of globalization (Cornescu *et al*, 2004; Toma, 2005; Marinescu *et al*, 2015a), the European Commission defines the social economy as encompassing a diversity of enterprises and organizations – such as cooperatives, mutual societies, non-profit associations, and foundations, including social enterprises – that prioritize social and/or environmental objectives and reinvest most of their profits to fulfil their mission (European Commission, n.d.). In a context marked by persistent socio-economic challenges, from poverty and social exclusion to the need for sustainable development, social economy actors play a crucial role in offering innovative solutions and strengthening social cohesion (Laville, 2013).

In Romania, the Romanian Orthodox Church (BOR), as the majority religious institutions, is a social actor with an extensive national presence which has developed a complex network of philanthropic and social assistance activities over time. Recently, there has been an increasing orientation of these efforts towards specific social economy models, integrating principles of social entrepreneurship and economic sustainability within its projects. This evolution reflects a deeper understanding of the social economy's potential to generate not only punctual assistance but also long-term community development and inclusion for vulnerable groups (Toma, 2013a; Toma, 2013b). As highlighted by Cace *et al* (2011), the BOR's social programs have intensified and diversified, especially in the context of economic crises, demonstrating the Church's capacity to mobilize resources and respond to emerging needs.

This paper aims to explore the social economy initiatives undertaken by the Romanian Orthodox Church, analyzing how they align with social economy principles and contribute to community development and social welfare in Romania. The work will examine the types of initiatives developed, implementation strategies, and their impact, based on the premise that the BOR

strategically uses economic solidarity, cooperative practices, and social entrepreneurship to achieve its social objectives. The research is structured as follows: the second section presents the literature review. The research methodology is illustrated in the third section of the study. The fourth section exhibits the findings. The paper ends with conclusions.

2. Literature review

The concept of social economy, although with deep historical roots in the cooperative and mutualist movements of the 19th century (Restakis, 2010), has been reconfigured and has gained new dimensions in recent decades. Polanyi (2001) criticized the tendency of the market economy to detach from society and emphasized the importance of re-embedding the economy in social relations, a central idea for understanding the social economy. The social economy is often described as a "third sector" (Monzón *et al*, 2008), distinct from the public sector (the state) and the private sector (the capitalist market), characterized by values such as solidarity, participatory democracy in governance, and the priority given to people and labor over capital in the distribution of income and surplus (Arthur *et al*, 2003).

Operational definitions of the social economy vary, but common elements include autonomy from the state, a decision-making process not based on capital ownership, and an explicit aim to serve community members or a general interest, rather than individual profit (Cace *et al*, 2011; Monzón *et al*, 2008). Social economy organizations, such as associations, foundations, cooperatives, and social enterprises, are key actors in providing social services, creating jobs, promoting social inclusion, and local development (Noya *et al*, 2007). All of them are socially responsible organizations (Toma, 2006; Toma, 2008a; Toma *et al*, 2011; Toma, 2012) which require effective and altruistic leadership (Marinescu *et al*, 2015b; Marinescu *et al*, 2015c; Toma *et al*, 2020a; Toma *et al*, 2020b; Toma, 2024a), lean (Naruo *et al*, 2007; Marinescu *et al*, 2008; Toma *et al*, 2022) and agile (Toma, 2023a) management, deep strategic thinking (Toma *et al*, 2016a; Toma *et al*, 2016b; Toma, 2023b), long-lasting strategies (Toma *et al*, 2013a; Toma *et al*, 2016c; Toma 2024b), entrepreneurial behaviour (Marinescu *et al*, 2017a; Grădinaru *et al*, 2018; Hudea *et al*, 2021) combined with creativity (Toma *et al*, 2013b; Marinescu *et al*, 2016) and innovativeness (Toma *et al*, 2016d; Marinescu *et al*, 2017b), and continuous learning (Toma, 2008b; Marinescu *et al*, 2013).

Social entrepreneurship represents a dynamic component of the social economy, combining entrepreneurial ingenuity with a social mission (Nicholls, 2006; Zainea *et al*, 2020). Social entrepreneurs identify social problems and apply entrepreneurial principles to organize, create, and manage initiatives that produce sustainable social change (Bornstein *et al*, 2010). This can also include "Knowledge-Based Social Entrepreneurship," where innovation and knowledge play a central role in developing social solutions (Kabir, 2019).

The role of faith-based organizations (FBOs) in the social sphere and, implicitly, in the social economy, is significant, although sometimes under-theorized in mainstream literature. FBOs, including churches, often have extensive networks, moral legitimacy, and the capacity to mobilize volunteers and financial resources for social causes (Cnaan *et al*., cited in Arthur *et al*., 2003, although Cnaan's direct source is not in the provided bibliography, the idea is generally valid). In Romania, the Romanian Orthodox Church has a long tradition of philanthropic activities which, in the current context, are evolving towards structured forms of social economy. The study by Cace *et al* (2011) on the BOR's social programs during the economic crisis highlights this transition and the Church's ability to adapt and respond to pressing social needs. They argue that in a fluid space marked by crises, institutions like the Church can become anchors of stability and essential providers of social support, with religion becoming a refuge for people at risk of exclusion.

The concept of "social and solidarity economy" (Laville, 2013) further expands the framework, emphasizing the plurality of economic forms and the importance of solidarity as an organizing principle. This perspective is relevant for analyzing BOR initiatives, which often combine income-generating economic activities with a mission deeply rooted in Christian values of charity and helping one's neighbor. The BOR's contribution is manifested not only through direct services but also by promoting values such as hope, peace, and equity, considered necessary for Europe (Basilica.ro, 2022g).

However, the integration of FBOs into the social economy framework is not without challenges, including aspects related to governance, professionalization, transparency, and the relationship with the state and other secular actors in the social economy (Cace *et al*, 2011). The development of a favorable legal and institutional framework is essential to support and maximize the impact of these initiatives (Cace *et al*, 2011).

3. Research methodology

The research method used is qualitative, consisting of an in-depth documentary analysis of the initiatives of the BOR in the sphere of social economy. The sources include official websites of the Romanian Patriarchate, annual reports, academic articles and papers published on this topic. The thematic analysis method was used to identify the main characteristics of the social activities carried out by the BOR.

4. Findings

The analysis of documentary sources, mainly articles published by the Basilica.ro News Agency, Ziarul Lumina, and the Filantropia Federation, reveals an increasingly structured and diversified involvement of the Romanian Orthodox Church in the field of the social economy. This involvement materializes through a wide range of initiatives that aim not only for punctual aid but also for the creation of sustainable support and social integration mechanisms.

- **Types of social economy initiatives developed by the Romanian Orthodox Church**

The identified initiatives can be grouped into several main categories, reflecting the application of social economy principles in various fields of activity:

Social Services with a sustainability and integration component:

Social canteens and bakeries: The BOR has developed numerous social canteens that provide food to disadvantaged individuals. Some of these are evolving towards social economy models by integrating income-generating activities or by involving beneficiaries in activities. For example, the Archdiocese of Roman and Bacău inaugurated a mobile social canteen for 100 people (Basilica.ro, 2023c), demonstrating flexibility in reaching those in need. The Severin Filantropia Association inaugurated a bakery workshop with a religious specificity (Basilica.ro, 2021b), which, in addition to its social purpose, can generate income to support other philanthropic activities and may offer jobs. Another social bakery was established within the project "SOLIDAR" (SOLIDAR – Support for the relaunch of employees and the development of new social enterprises) in the Diocese of Severin and Strehaia (Basilica.ro, 2021c).

Care and assistance centers: The BOR manages numerous centers for the elderly, children, people with disabilities, and other vulnerable groups. A relevant example is the new palliative care clinic in Botoșani, consecrated by His Eminence Teofan, which underscores the importance of caring for one's neighbor (Basilica.ro, 2023f). The "Sf. Voievod Ștefan cel Mare" Social Settlement in Hârja, Bacău County, diversified its social services with the support of the Bacău County Council and marked five years of activity by consecrating new premises, indicating development and consolidation of the services offered (Basilica.ro, 2023e; Basilica.ro, 2021a). The Archdiocese of Iași began the construction of the "Sf. Emilia" Maternal Center during the Month for Life, addressing mothers and children in difficult situations (Basilica.ro, 2023h).

- **Work Integration Social Enterprises (WISEs):**

These are social economy structures whose main purpose is the labor market integration of people who are difficult to employ.

Production workshops: In addition to the aforementioned bakery, social enterprises were established in Alba County with European funds, including tailoring, candle-making, and bakery workshop (Basilica.ro, 2018). These provide jobs and vocational training for people from vulnerable groups. A new social project in the Diocese of Severin, "Social Economy Business," aimed to establish five social enterprises, including a candle factory, a car wash, and a carpet laundry, with the goal of creating 25 jobs for vulnerable individuals (Basilica.ro, 2020b). A new social economy

structure was also inaugurated in Drobeta Turnu Severin, aiming to create jobs for people from vulnerable groups (Basilica.ro, 2024).

Shops with monastic and artisanal products: The Archdiocese of Suceava and Rădăuți inaugurated a shop with natural products in Câmpulung Moldovenesc (Basilica.ro, 2023g). These shops not only promote products made in monasteries or by local artisans but can also function as social enterprises, with revenues directed towards the Church's social works.

- **Social Entrepreneurship and Community Development Projects:**

The BOR is also involved in promoting the concept of social entrepreneurship and in developing projects that stimulate the local economy with a social purpose. The social entrepreneurship project "SOLIDAR" was presented in Covasna and Harghita, indicating the dissemination of good practices and encouragement of local initiatives (Basilica.ro, 2022f). Also, a social economy project in the Archdiocese of Vad, Feleac, and Cluj, named "ECOSOCIAL", aimed to establish 8 social enterprises and create 40 jobs (Basilica.ro, 2022a). These projects often benefit from European funding, demonstrating the BOR's ability to access and manage such funds. The impact of jobs generated by the social economy is a topic of interest, highlighting the direct economic benefits brought to communities (Basilica.ro, 2023d).

- **Training, Consultancy, and Awareness Activities:**

In addition to concrete initiatives, the BOR is also involved in training activities in the field of social economy and in promoting this model. The organization of an international symposium on social economy in Sibiu (Basilica.ro, 2023i) demonstrates the commitment to the theoretical and practical development of the sector. The BOR also participates in European consultations, conveying values such as hope, peace, and equity, essential for harmonious social development (Basilica.ro, 2022g). The need for cooperation between the State and Religious Denominations for the good of society is also emphasized, an important aspect for creating an environment favorable to the social economy (Basilica.ro, 2019).

Platforms such as Ziarul Lumina (Filantropie section) and Federația Filantropia (Proiecte section) centralize and present a multitude of such initiatives at the national level, illustrating the scale of the BOR's involvement (Ziarul Lumina, n.d.; Federația Filantropia, n.d.). For example, the Archdiocese of Alba Iulia reported expenditures of 6.6 million euros in 2021 to support vulnerable people, a considerable sum reflecting the extent of social efforts, part of which is undoubtedly directed towards or through social economy structures (Basilica.ro, 2022e).

The social economy initiatives of the Romanian Orthodox Church, as revealed by the analyzed data, demonstrate a clear alignment with the fundamental principles of the social economy, as defined in the specialized literature (Noya *et al*, 2007; Monzón *et al*, 2008; European Commission, n.d.).

Economic solidarity and the primacy of the person: The main mission of these initiatives is to support vulnerable individuals and groups – the unemployed, people with disabilities, victims of domestic violence, single mothers, the elderly, disadvantaged children. The emphasis is on human dignity and providing opportunities, not just material assistance. This aspect is consistent with Polanyi's (2001) critique of the dehumanization of the economy and the call for its re-embedding in social values.

Social entrepreneurship: The BOR demonstrates an increasing capacity to adopt entrepreneurial models to solve social problems (Nicholls, 2006; Bornstein and Davis, 2010). The establishment of bakeries, production workshops, shops, and other income-generating structures, whose profits are reinvested for social purposes or which employ people from vulnerable groups, are clear examples of social entrepreneurship. Projects like "SOLIDAR" or "ECOSOCIAL" indicate a strategic approach to promoting this type of entrepreneurship.

Cooperative and partnership practices: Although detailed information about the internal governance structure of these entities is not always explicit in the analyzed sources, the nature of many projects suggests a collaborative approach. Partnerships with local authorities (e.g., Bacău County Council), access to European funds, and collaboration within networks such as the Filantropia Federation indicate an understanding of the importance of cooperation in achieving social objectives, a central aspect in the cooperative and solidarity economy (Restakis, 2010; Laville, 2013).

Sustainable community development and social inclusion: By creating jobs, providing essential services (health, education, care), vocational training, and support for labor market integration, BOR initiatives contribute to the sustainable development of local communities and to increasing social inclusion. They represent a form of "social capital" and contribute to strengthening the social fabric, especially in rural or disadvantaged areas.

The BOR's involvement in the social economy also aligns with the findings of Cace et al. (2011) regarding the Church's active role in mitigating the effects of economic crises and providing social services where the state cannot cover all needs. A transition is observed from traditional philanthropy, based on charity, to more complex social economy models that emphasize autonomy, sustainability, and long-term impact. This evolution can be seen as a "humanizing of the economy" at the micro-social level, in the spirit of Restakis's (2010) ideas.

However, for a more in-depth analysis, future research would be needed to examine in detail the governance models of these social enterprises, their long-term financial sustainability, the measured impact on beneficiaries, and the specific challenges they face (e.g., regarding professionalization, market access, competition, etc.), aspects mentioned as relevant in the specialized literature (Cace et al., 2011). It is also important to explore how these initiatives integrate into broader local and national development strategies.

5. Conclusions

This paper has explored the social economy initiatives undertaken by the Romanian Orthodox Church, highlighting their significant role in community development and promoting social welfare in Romania. The analysis, based on qualitative methods and the examination of public documentary sources, has revealed an extensive and diversified involvement of the BOR in this field, moving beyond the traditional framework of philanthropy to adopt specific models of social entrepreneurship and work integration social enterprises.

The main findings indicate that the BOR has developed a considerable network of social economy units, including social services with a sustainability component (social canteens, bakeries, care centers), work integration social enterprises (production workshops, shops with monastic products), social entrepreneurship projects, and training and awareness activities. These initiatives are implemented at the diocesan level, often in partnership with local authorities or by accessing European funds, and are coordinated and promoted through structures such as the Filantropia Federation.

The study underscores the Church's strategic use of social economy principles – economic solidarity, cooperative practices (in the broad sense of collaboration), and social entrepreneurship – to achieve its social objectives. These initiatives concretely contribute to the social inclusion of vulnerable groups, job creation, the provision of essential services, and the sustainable development of local communities. They reflect an adaptation of the Church's traditional mission to the contemporary socio-economic context, demonstrating its capacity to innovate and respond effectively to societal needs.

The BOR's contribution to the Romanian social economy is, therefore, substantial, aligning with European efforts to promote a more inclusive and social welfare-oriented economic model. As discussed, these actions fit within the theoretical concepts of the social economy, the third sector, and social entrepreneurship, offering a concrete example of how a faith-based organization can play an active and transformative role in society.

The main limitation of this study lies in the exclusive use of public data, which may offer a partial picture. Future research could deepen the analysis through detailed case studies, interviews with involved actors (managers of social enterprises, beneficiaries, BOR representatives), and quantitative evaluations of the socio-economic impact of these initiatives. A comparative analysis with similar initiatives by other religious denominations or secular organizations in Romania and other countries would also be useful.

In conclusion, the social economy initiatives of the Romanian Orthodox Church represent a vital component of efforts to combat poverty and social exclusion in Romania, demonstrating a profound commitment to community development and the promotion of an economy with a human face.

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Euphemisms and Idioms Cropping up in Business Rhetoric

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Abstract

A careful understanding of the linguistic aspects of business interactions has to do with a good knowledge of euphemistic and idiomatic expressions which often crop up in corporate communication. The paper is designed with two purposes in mind.

First, it attempts to provide an analysis of numerous verbal softeners (euphemisms) in terms of length, structure, and function, with important implications for business vocabulary expansion.

Second, it aims to classify native language idioms and set phrases according to the area of usage. Thus, the outcome of my research is to enhance familiarity with informal, nonstandard forms of communication focused on contextual business factors and offer more flexibility in unblocking miscommunication.

The results indicate that gaining an insight into the meanings of euphemisms and idioms can enable interlocutors to use them accurately in respective business settings.

Key words: areas of usage, corporate rhetoric, euphemisms, idioms, language

J.E.L. classification: Z13

1. Introduction

By using the phrase *language behaviour* to refer to the choice of language that each of us has when the occasion demands, we can switch varieties according to the field of discourse, medium, or attitude.

A discussion of politeness and impoliteness leads to the motivations for preferring orthophemisms, euphemisms, or dysphemisms in everyday language, in general, and in business language, in particular. As Allan and Burridge (2006) argue, language expressions are constantly subject to censoring and taboo, suggesting that cross-varietal synonymy should predominate in examining the effects on language: "Discussion of taboo and the censoring of language naturally leads to a consideration of politeness and impoliteness, and their interaction with euphemism (sweet talking), dysphemism (speaking offensively) and orthophemism (straight talking). The term *euphemism* is well known; but its counterpart *dysphemism* rarely appears in ordinary language. *Orthophemism* is a term we have coined in order to account for direct or neutral expressions that are not sweet-sounding, evasive or overly polite (euphemistic), nor harsh, blunt or offensive (dysphemistic) [...] Important to this discussion is the concept of *cross-varietal synonymy*, i.e. words that have the same meaning as other words used in different contexts" (Allan and Burridge, 2006, p.29).

Moreover, corporate rhetoric makes extensive use of imagistic metaphors, idiomatic expressions which powerfully step in almost everything we do: setting up a business, selling products, negotiating contracts, making decisions, implementing changes, or taking new opportunities. Making an effort to learn our business counterpart's language widely helps us begin to think from their perspective and grasp the meaning of certain words.

Thus, the focus will be on the linguistic analysis of certain bland expressions based on the understanding of and familiarization with the prevailing value systems of particular speech communities and the culture-specific metaphors whose multiple meanings can be troublesome when communicating in a new business environment.

2. Literature review

One set of lexical items which traces back to the principle of politeness (Lakoff, 1973; Grice, 1975; Brown and Levinson, 1987; Leech, 2005, 2007, 2014) and indirectness is represented by euphemisms.

Whether *glittering generalities*, *purr words* (Mills, 2000), *inoffensive expressions* (Chaney and Martin, 2007), *sweet talking* (Allan and Burridge, 2006), or *the stealth bombers of rhetoric* (Krogerus and Tschäppeler, 2018), *euphemisms* are the ace we have up our sleeve to fight against verbal taboos and other categories of offensive language (swearing, insults, derogatory comments). The existing vocabulary of nasty things is refreshed with new expressions whose figurative meanings decontaminate the common perception (referential meaning) of the denotata. They are sensitive to factors like social standing, the relations between speakers, the topics for discussion, the setting, or, to put it differently, they are context, place and time dependent. At the same time, they are vague, indirect expressions that sound good to the listener or, as Neaman and Silver put it "substituting an inoffensive or pleasant term for a more explicit, offensive one, thereby veneering the truth by using kinds words" (Neaman and Silver, 1990, p.4). Others are of the opinion that euphemisms obfuscate language: "Euphemisms are the stealth bombers of rhetoric. At first glance they are not visible, but their attacks are insidious: by the time you become aware of them, the damage is already done" (Krogerus and Tschäppeler, 2018, p.166).

As far as the spectrum of idiomacity and the areas of usage are concerned, Cooper's (1998) perspective is more oriented towards the difficulty level of idioms which he classifies into three groups, i.e. *frozen idioms*, *transparent idioms*, and *opaque idioms*, insisting on the connection between the literal and figurative meanings of the expression: "the linguistic characteristics of idioms, such as the degree of syntactic flexibility and the closeness between literal and figurative meanings, affect the ease with which they can be acquired" (Cooper, 1998, p.257).

In the same line of approach, Maalej (2005) posits the question of cultural background, considering that idioms and metaphors conjure up a language which is specific within a given culture: "Culture-specific metaphors are best represented in phraseology. Native language idioms and set phrases can blend together ethno-specific concepts pertaining to the world view of its speakers, to their national character, as well as their traditional social relations, thus becoming an embodiment of national dispositions and spiritual values. They are presented metaphorically indirectly and figuratively, which is why culture-specific metaphors produce idioms that have no corresponding counterparts in another language" (Maalej, 2005, p.215).

In a contribution by Ter-Sargsyan (2017) the aim was to emphasize the importance of teaching idioms in business English from an Armenian perspective. The study forcefully points to the idea that it is essential for students majoring in business to learn specific set phrases or idioms which will enable them to communicate in appropriate business settings. To address this, the article also concentrates on a wide range of classroom activities for teaching business English idioms through online learning resources, such as *fluentu.com* website (Nash, 2025) providing illustrations/pictures of idioms followed by their contextual use and translation.

The business idioms landscape is enriched by Malyuga and Aleksandrova's (2020) study which sheds light on the communicative-pragmatic aspect of idiomatic expressions in English business discourse. Thus, special attention is paid to the figurative tools used by English-speaking business people whose idiomatic richness accounts for 40% of the examined sample. In agreement with Maalej's (2005) and Savitsky's (2019) approach to cultural codes in professional discourse and communication, Malyuga and Aleksandrova take a similar stand when referring to idioms as the vehicles of thought contributing to the creation of a figurative portrayal of the world, transmitting native speakers' cultural codes. Their findings underscore the necessity of devising a 5-sized linguopragmatic analysis of the most frequent semantic groups of idiomatic expressions given the ever-growing interactions between business people.

A recently published study by Sadigzade (2025) focuses on teaching idiomatic expressions, with a positive impact on students' lexical competence. The researcher aims to prove the tangible benefits of idiomatic proficiency in real-world communication. The article shapes a new approach on the basis of three parameters, i.e. benefits (richness and depth of language), challenges (potential for misunderstanding), and solutions (contextual learning and extensive usage practice). Through

many references to other similar studies in the field, it underscores the importance of precise usage as a highly recommended method through conversations, multimedia resources, videos, etc. Findings reveal that, in the business context, for instance, the appropriate use of idioms such as "think outside the box" or "hit the ground running" can lead to achieving fluent communication and fostering better relationships with colleagues and clients.

3. Research methodology

This research has concentrated on offering an insight into the tactful, tentative language (mild, gentle phrases as main forms of euphemisms) which contributes a lot to the creation of favourable business relationships, on the one hand, and making an effort to learn our business counterpart's language by grasping the meaning of certain words, on the other. The emphasis was placed on the air of freshness and novelty due to the power of metaphors (idiomatic expressions) coming from contexts like sport, secrecy and discretion, entertainment, or theatre which become the meaning-forming base for many idioms used in the English business discourse.

The research methodology has aimed to focus on different uses of indirect, friendly versions of words/phrases deemed unpleasant or embarrassing as tools to help us appear more cooperative and likeable to our interlocutors, and the extensive use of idiomatic expressions which are doing the rounds in the business lexicon nowadays.

In this case, I have provided examples of bland phrases, grouped them into the parts of speech they belong to (nouns, adjectives, verbs) and established a few contexts in accordance with some specific situations characteristic of business deals, workplace relations, or product selling. As regards the idiomatic expressions, I have suggested some classifications and insisted on specific categories of idioms (and their common origins) in order to 'fix' the meaning of these expressions which are more difficult to understand and grasp new vocabulary words.

Research has shown that keeping up with the current trends in intercultural business environment can greatly help us enhance our vocabulary breadth with terminology (phraseology) whose meaning is contextually specific.

4. Findings

The results of the paper can be structured around two communication axes, i.e. interpreting business euphemisms as a form of linguistic polishing/whitewashing language and classifying native language idioms and set phrases according to the area of usage.

4.1. Euphemisms' variation in terms of length, structure, and function

From the corporate buzzwords classification point of view, there is a large class of business terms (*euphemisms*). Various online sources include a mixture of words and phrases which have been created to mask the rudeness of certain words (Clark, 2020 <https://languageonlineservices.com/2020/02/35-business-euphemisms/>; Schneider, 2011 <https://lynnschneiderbooks.com/2011/12/23/20-examples-of-great-euphemisms/>; Summers, 2007 <https://archive.org/details/longmanbusiness0000unse>; *The Ridiculous Business Jargon Dictionary* <https://businessjargon.com/dictionary-a-words/>).

From the linguistic point of view, all these words should be arranged according to the parts of speech they belong to, the psychological state they create or the emotions they lead to, as I suggest below:

a) verbs → *apple polish* – suck-up (informal: *apple polish to the boss*) to compliment someone insincerely; *bottom line it* (to summarize); *break your crayons* (to tread on somebody's toes; to get on somebody's nerves, ruining their day: e.g. *He purposely deleted the clause from the contract. He's just trying to break your crayons*); *do the needful* (to work for money); *eat the reality sandwich* (to wake-up from delusions; do not have unrealistic expectations or unreasonable hopes: e.g. *If you still think you'll get a higher position, even though your performance has been terrible lately, you'd better / you seriously need to eat the reality sandwich*); *put a lipstick on a pig* (to embellish a negative, unappealing product so that it appears more pleasant and profitable than it

was before); *promote to customer* (to fire); *air/wash your dirty linen* (to bring your personal problems into the open); *milk somebody for something* (cynical euphemism; to seize an opportunity for your own ends, often unfairly: e.g. *The directors have been accused of milking the company for several million dollars*);

b) adjectives → *back-of-the-envelope* (financial calculations made without careful planning or completed in a quick, reckless manner: e.g. *back-of-the-envelope calculations*); *lost in the sauce* (misguided, lacking job orientation: e.g. *lost in the sauce new recruits*); *on the carpet* (summoned by your superior to explain a serious error, such as spending excessively: e.g. *They were called on the carpet for devaluation of company accounts*); *ninth inning* (a baseball term meaning something left to the last moment: e.g. *The hostile takeover was completely ninth inning*); *uber* (a borrowed German word: better, larger, or greater; very, super: e.g. *I'm uber-excited by the prospect of a partnership. I'm uber-excited by this job opportunity.*); *lukewarm* (uninterested (in), unexcited (by); lacking enthusiasm for something: e.g. *The stock market took a lukewarm reaction to the announcement. The government got a lukewarm reception from oil companies*); *(be) a snip* (a bargain-basement good or service: e.g. *At £5 for two sets of creams, they are a snip!*);

c) nouns → *dead beat* (a bad taxpayer: e.g. *raise taxes on dead-beats*); *loss leader* (a product or service which is sold cheaply but which is hoped to bring great profits later); *the milk round* (cynical, dishonest euphemism meaning advantageous job offers made by companies in colleges to determine students to work for them: e.g. *The firm's new sales representatives were selected on the milk round*); *dirty laundry* (dysphemistic euphemism – illegal business documents or unfair/dishonest business activities/practices which an organization would prefer to keep under lock and key); *involuntary entrepreneur* (an out of job employee who is forced into taking on new jobs to supplement his/her income); *knowledge density* (an unclear/confused/vague idea about something; a limited capacity to provide quality information in an area of work or study: e.g. *I'm sorry, I don't have the knowledge density to act on the information*); *low decision latitude* (the inability of low-ranking persons to take important decisions: e.g. *Employees have low decision latitude in organizing their work*); *ear candy* (slang - a praise or nice compliment that is pleasant to the ears); *(an) empty suit(s)* (a rich but superficial businessman lacking substance and personality: e.g. *He's nothing but an empty suit who couldn't run the business but for the help of his peers*); *meltdown* (a nuclear energy metaphor meaning a frail economic situation in which prices fall dramatically and product sales result in huge losses: e.g. *financial meltdown: Prices plummeting for the fourth consecutive day might lead to a near meltdown in overseas stock markets*); *my understanding* (an evasive answer to a question that avoids a definite 'yes' or 'no'); *perfect storm* (a mixture / load of unfavourable business events that weaken the economy leading to catastrophic results: e.g. *Business analysts are experiencing the perfect storm of galloping inflation, huge foreign debt and an unskilled/a shrinking labour force*); *white elephant* (an unsound and useless/impractical building for which a lot of money was invested: e.g. *The old pavilion for trade exhibitions is in bad condition – a white elephant of impressive proportions*).

The Guardian's Careers Blog compiles a set of the worst office jargon (*irritating euphemisms*) that 'knowledge workers' seem to be very fond of, using language that is unnecessarily long and complicated, and disguising the fact that their business might be in trouble. We can just ward off our uncertainty about some of these impressive-sounding phrases (Smith, 2014 <https://www.theguardian.com/careers/careers-blog/worst-office-jargon-phrases-staff-love-hate-management-speak>):

Instead of using:	Prefer:
- <i>Helicopter view</i> (of the business)	Broad overview or summary of an issue ('a bird's-eye view')
- <i>Low/ not enough bandwidth</i>	Too busy to take on extra work
- <i>Touch base offline</i>	Let's meet and talk.
- <i>We should pivot that idea.</i>	We should put this idea differently.
- <i>Idea shower/Thought shower</i>	Let's come up with more ideas.
- <i>Don't boil the ocean</i>	Don't waste time.
- <i>Low hanging fruit</i>	Earning a quick profit with little effort
- <i>It's on my radar</i>	I'm aware of this. /I'll focus attention on this.
- <i>Close of play</i> (sport metaphor)	It's the end of the day.
- <i>Peel the onion; Sweep the sheds</i>	Examine a problem in detail

- *Be in the saddle*

Manage, oversee

4.2. Idioms' classification according to the area of usage

According to LinguaLink DC (22 Dec 2016), "Depending on your cultural background, some idioms might sound very familiar or can even be used in your native language while others might seem strange, confusing or even funny" (<https://www.lingualinkdc.net/blog/10idioms>). It states the frequency with which idioms pervade the languages of different countries - rugby idioms are very common in Australia, football and baseball idioms are widely used in the United States - and classifies idioms according to the area of usage:

a) Idioms about secrecy and discretion:

- ***behind closed doors*** (if something happens behind closed doors, it happens in private and the public are not allowed in)

e.g. *The members of the creditors' committee discussed the sale of the company behind closed doors.*

- ***to spill the beans*** (to reveal a secret that someone else wanted you to keep)

e.g. *The unexpected merger split the beans of some blocked accounts.*

- ***to cover your tracks*** (to hide or destroy evidence of what you have done so that other people cannot find out)

e.g. *She started to destroy compromising documents to cover her tracks.*

- ***to keep someone in the dark*** (if you ~, you don't inform them about something)

e.g. *Many workers were kept in the dark about the company's plans to relocate its corporate headquarters.*

b) Idioms from the area of entertainment:

- ***behind the scenes*** (theatre metaphor describing something that is done in great secret, while other things are happening publicly).

e.g. *Behind the scenes, both parties are making a deal to sell the land to a real-estate developer).*

- ***waiting /lurking in the wings*** (stage metaphor: ready to act when the time is right)

e.g. *Several executives are lurking in the wings ready for promotion to new posts as part of the reorganization;*

- ***a balancing act*** (circus metaphor, euphemism: a difficult compromise; when you are trying to please two or more people or groups who all want different things, or who have ideas that are completely different from each other)

e.g. *The government had to perform a balancing act of preserving the economic interests without neglecting the environmental ones.*

- ***to run the show*** (theatre metaphor: to be in charge of an area of activity, affair, business, etc.)

e.g. *Given that the CEO retired from the business, his son is running the show now.*

Since that business is running the show, marketing the product will be a guaranteed success.

5. Conclusions

Seen retrospectively, the existence of euphemisms in business rhetoric could be interpreted as an antidote to offensive language, a veneer of politeness, as well as a forceful instrument of manipulation through the power of language to control thoughts.

Among other forms of verbal interaction, 'special topics' idioms are some of the most common and numerous of all idioms and have to be taught and learnt as fixed expressions, each with its own meaning.

That is why it is best to learn each combination as a phrase, rather than try to remember the adjective, noun and verb separately. Although they clearly break the established linguistic rules, these phrases make the conversational tone of certain business situations more expressive and more colourful.

On the basis of the above examples it can be concluded that, in order to get a good knowledge of euphemisms and idioms, business people should engage in fluent and culturally aware communication that will enable them to grasp contextual nuances, connotations, new word meanings, and delve into the subtleties of corporate language.

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Section IV

Marketing – Management

Industry 4.0: Competitive Strategies and Sustainability

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Abstract

Industry 4.0 has transformed the way companies operate by leveraging new technologies such as Internet of Things, artificial intelligence, and automation. This has transformed the way businesses compete and practice sustainability. More and more competitive strategies and sustainability interact within the setting of Industry 4.0 as new technologies influence firms' competitive strategies to achieve long-term objectives. The objective of the study is to ascertain the impact of Industry 4.0 technologies on competitive strategies and their implications for sustainability. The findings reveal that Industry 4.0 promotes innovation and offers businesses a competitive advantage, but it also introduces challenges such as increased resource requirements and ethical issues. The report concludes with recommendations for balancing competitive demands with long-term practices, emphasizing the need of regulations and collaboration. The emphasis on qualitative data is a constraint, thus future study should explore for ways to confirm the findings quantitatively.

Key words: Industry 4.0, competitive strategy, sustainability, digital transformation, circular economy

J.E.L. classification: M10, M19

1. Introduction

Since the beginnings of the 1990s, the age of globalization has profoundly changed the business world. It has led to the expansion of trade and the free movement of capital, people, and information at a global scale (Cornescu *et al*, 2004; Toma, 2005). Industry 4.0 represents a significant transformation in corporate operations in an increasing digital economy (Ansong *et al*, 2019). It integrates cyber-physical systems, the Internet of Things (IoT), and artificial intelligence (AI) and provides numerous opportunities to innovate (Toma *et al*, 2018; Tohănean *et al*, 2024). This technology revolution enhances productivity and creativity, while simultaneously altering competitive dynamics among organizations and mandating a focus on sustainability.

There is evidence about the relationship between digitalization, competitive strategies and sustainability within the framework of Industry 4.0 showing how businesses leverage emerging technology to surpass competition while fulfilling their social and environmental obligations (Thampapillai, 2010; Anitha *et al*, 2024; Rehman, 2025). The objective of the study is to ascertain the impact of Industry 4.0 technologies on competitive strategies and their implications for sustainability. The research discusses how technology serves as both a catalyst for market competitiveness and a means to enhance sustainability by examining these processes. The structure of this study is as follows: the second section displays the literature review. The research methodology is illustrated in the third part of the study. The fourth section presents with the findings. The paper ends with conclusions.

2. Literature review

Studies on Industry 4.0 demonstrate its innovative impact on managerial processes, manufacturing activities and service delivery (Marinescu *et al.*, 2016; Marinescu *et al.*, 2017a; Tohănean *et al.*, 2018). Kagermann *et al.* (2013) define Industry 4.0 as the application of digital technology to create smart factories that exhibit enhanced efficiency and flexibility. It is more and more obvious that real-time data analysis, automation, and supply chain streamlining provide organizations with a competitive advantage. However, these enhancements need substantial resources, raising concerns regarding their sustainability (Ghobakhloo, 2020).

The ideas of resource efficiency, waste minimization, and a circular economy are essential for sustainability in Industry 4.0. Lasi *et al.* (2014) assert that intelligent technologies enable more precise resource management, hence reducing environmental footprints. According to Stock *et al.* (2016), Industry 4.0 facilitates circular economy models via technologies such as the use of additive manufacturing, which promotes recycling and product reuse. Conversely, digital infrastructure consumes significant energy and presents ethical concerns such as safeguarding information (Bonilla *et al.*, 2018).

Competitive strategies and sustainability are interconnected, as businesses leverage green technology to differentiate themselves in competitive marketplaces while fulfilling regulatory and consumer requirements (Bocken *et al.*, 2014; Toma *et al.*, 2019; Ejsmont *et al.*, 2020). Recent study indicates that the triple bottom line (TBL) paradigm deep related to corporate social responsibility (Toma, 2006; Toma, 2008a; ; Toma *et al.*, 2011; Toma *et al.*, 2012a), encompassing economic, environmental, and social elements, proves essential for assessing the sustainability of Industry 4.0 (Machado *et al.*, 2020). For instance, the Internet of Things and big data analysis enhance the industrial process. Reducing emissions benefits the ecosystem and enhances the economy's sustainability (De Sousa Jabbour *et al.*, 2018). However, social sustainability, particularly its impact on the workforce, remains insufficiently addressed. Automation generates apprehensions over employment displacement (Bag *et al.*, 2021). This is why more and more business organizations, irrespective their field of activity, have understood the requirements of operating in an ever-changing environment (Toma, 2013; Marinescu *et al.*, 2015a; Toma *et al.*, 2015) under the auspices of the Fourth Industrial Revolution as follows: profound strategic thinking (Toma *et al.*, 2016a; Toma *et al.*, 2016b; Toma, 2023a), enduring business strategies (Toma *et al.*, 2013a; Toma *et al.*, 2016c; Toma 2024a) and sustainable business models (Toma, 2008b; Toma *et al.*, 2016d), intelligent leadership (Marinescu *et al.*, 2015b; Toma *et al.*, 2020; Toma, 2024b), vivid entrepreneurialism (Marinescu *et al.*, 2017b; Grădinaru *et al.*, 2018; Catană *et al.*, 2020; Hudea *et al.*, 2021), creative acumen (Toma *et al.*, 2013b; Marinescu *et al.*, 2017), lean (Naruo *et al.*, 2007; Marinescu *et al.*, 2008; Toma *et al.*, 2022) and agile thinking (Toma, 2023b), quality management (Toma *et al.*, 2009; Toma *et al.*, 2012b), employing different managerial methods such as balanced scorecard (Toma *et al.*, 2010), Six Sigma (Toma, 2008c), marketing mix (Marinescu *et al.*, 2010; Grădinaru *et al.*, 2017; Catană *et al.*, 2021), customer experience (Toma *et al.*, 2021a; Toma *et al.*, 2021b) and training programs (Toma, 2012; Marinescu *et al.*, 2013).

3. Research methodology

This study used a qualitative research technique to examine the interplay between digitalization, competitive strategies, and sustainability within the context of Industry 4.0. The research design is based on a thorough and systematic review of existing literature, primarily concentrating on articles from peer-reviewed journals, academic publications, and authoritative reports from reliable sources in the fields of Industry 4.0, competitiveness, sustainability, digital innovation, and circular economy. The selection of pertinent material was directed by its relevance to the primary research challenge and its evident contribution to a more profound comprehension of the nexus between sustainability, competitiveness, and technological progress.

The systematic review involved an examination and integration of existing conceptual frameworks and current models that examine this intricate interaction. This comparative analytical methodology facilitated the identification of best practices and prevalent obstacles faced by companies in aligning competitive strategies with expressed sustainability objectives. The results

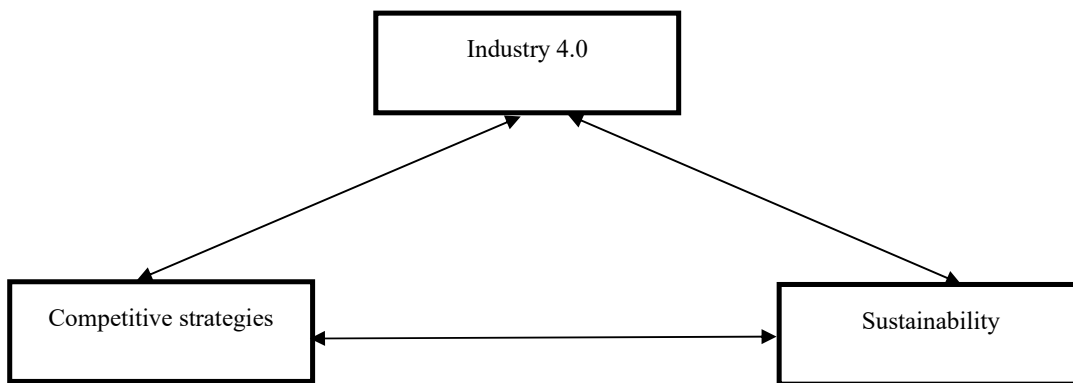
obtained from the extensive literature review were closely analyzed to establish substantiated conclusions about the influence of competition and long-term sustainability of businesses in relation to Industry 4.0, as well as to identify the essential factors that facilitate the successful integration of each of these pivotal concepts.

4. Findings

The authors' literature research discusses the interrelations among competitive strategies, sustainability, and Industry 4.0, conceptualized as the vertices of a triangle (Figure 1). This encompasses resource optimization, competitive advantage, circular economy integration, and data-driven decision-making. The Internet of Things and artificial intelligence provide real-time monitoring and modifications, therefore decreasing expenses and improving competitiveness. Predictive maintenance minimizes downtime, hence improving operating efficiency (Lee et al, 2015; Frank et al, 2019).

The concepts of resource efficiency, waste reduction, and a circular economy are vital for sustainability in Industry 4.0, as outlined in the preceding literature research. Lasi et al. (2014) suggest that intelligent technologies provide more accurate resource management, hence diminishing environmental footprints.

Figure no. 1. The competitiveness-sustainability-Industry 4.0 triangle



Source: Authors' contribution

To further emphasize the principles described in the literature study, the writers reference Stock et al. (2016). They contend that Industry 4.0 facilitates circular economy models via technologies such as additive manufacturing, which improves recycling and product reuse.

Conversely, digital infrastructure necessitates considerable energy and presents ethical concerns, particularly regarding data privacy (Bonilla et al., 2018). Consequently, the subsequent three notions ought to be derived.

Firstly, technology, such as additive manufacturing, facilitates circular economy models by enabling product reuse and recycling. This aligns with sustainability objectives and assists organizations in enhancing their market position via environmentally conscious marketing (Geissdoerfer et al, 2017; Dantas et al, 2021).

Secondly, the authors believe data-driven decision-making to add a significant impact in formulating the relevant strategies. Large data analysis enable organizations to anticipate market trends, fostering innovation. Data centers consume substantial energy, adversely impact the environment; hence, it is imperative to identify methods for reducing energy consumption (Mittal et al, 2019; Ghobakhloo, 2020).

And lastly, the authors have also identified certain challenges and trade-offs as a result of adopting the use of certain technology, such as artificial intelligence, in the strategic framework of companies. Elevated operational expenses may divert funds from sustainability initiatives. Moreover, moral dilemmas, such as unemployment and data privacy, complicate the pursuit of equilibrium between competitiveness, competitive strategies and sustainability for society (Bonilla et al, 2018; Nara et al, 2021).

The results indicate that Industry 4.0 may boost the sustainability of competitive strategies, however, strategic planning is essential to prevent trade-offs.

5. Conclusions

The results of this research suggest that Industry 4.0 technologies may enhance competitive strategies and sustainability. However, their integration requires rigorous oversight. The systematic review approach corroborates the findings drawn. Nonetheless, their qualitative nature renders them less applicable in alternative contexts. A quantitative approach will likely be employed in subsequent research to ascertain the impact of certain technology on competitive and long-term results. The study's credibility is enhanced by its reliance on peer-reviewed sources. It also faces challenges due to the constantly evolving nature of Industry 4.0, which may introduce more factors. Generalizing the data indicates that organizations need to collaborate, particularly through industry relationships, and utilize legislative frameworks to reconcile their sustainable objectives with competitive necessities. Policymakers should promote the use of sustainable technologies to align economic and environmental objectives.

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Entrepreneurship in the Digital Age: Adaptation and Innovation

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Abstract

The rapid pace of digital transformation has brought unprecedented opportunities and challenges for entrepreneurs worldwide. This paper explores how entrepreneurial practices have evolved in the digital era by analyzing emerging digital business models, core adaptation strategies, and the innovative tools used by startups and SMEs. The study highlights key trends shaping entrepreneurship in the context of technology disruption and outlines how digital entrepreneurs leverage agility, innovation, and digital platforms to sustain growth. Real-world examples are used to support the theoretical framework.

Key words: digital entrepreneurship, innovation, digital platforms, business adaptation, SMEs

J.E.L. classification: L26, O33, M13, M15

1. Introduction

In the past two decades, digitalization has fundamentally reshaped the way businesses are created, developed, and scaled. Digital transformation is no longer a competitive advantage—it has become a prerequisite for the long-term survival and success of enterprises, particularly start-ups and small firms. In this context, digital entrepreneurship has emerged as a distinct form of economic activity, characterized by intensive use of technology, rapid scalability, and a continuous drive for innovation.

Entrepreneurs operating in the digital age no longer function within the static framework of the industrial economy. Instead, they navigate a dynamic environment defined by global competition, technological disruption, and unprecedented access to digital resources. Tools such as e-commerce platforms, social media, cloud computing, and artificial intelligence have democratized entrepreneurship, enabling a broader range of individuals and teams to launch and grow ventures with limited capital.

However, digitalization also presents significant challenges. These include the accelerated pace of technological change, the continuous need to acquire and update digital skills, the transformation of traditional business models, and the pressure to continuously innovate. As such, continuous learning, strategic agility, and innovation orientation have become critical success factors for entrepreneurs in the digital economy.

The aim of this article is to explore how entrepreneurship is adapting to the digital era by identifying key strategies, emergent business models, and real-world examples that illustrate digital innovation in action. Through this analysis, we seek to provide a conceptual framework and practical insights that may guide current and future entrepreneurs in navigating digital transformation processes.

2. Literature review

The evolution of entrepreneurship in the digital age has sparked a growing body of academic research concerned with how new technologies, platforms, and digital ecosystems reshape entrepreneurial processes, behaviors, and outcomes. Digital entrepreneurship, as a concept, does not merely imply the use of digital tools; rather, it encompasses a paradigm shift in how entrepreneurs create, deliver, and capture value in increasingly complex and dynamic environments.

Digital entrepreneurship is defined as the pursuit of entrepreneurial opportunities through the use of digital technologies and digital infrastructures (Nambisan, 2017). It differs from traditional entrepreneurship by being less constrained by physical location, industry boundaries, or scale limitations. Digital entrepreneurs can operate leaner, scale faster, and access broader markets due to the widespread availability of internet technologies, cloud computing, social media, and mobile applications (Hull et al., 2007). As noted by Kraus et al. (2019), digital entrepreneurship is particularly relevant for small and medium enterprises (SMEs), as it lowers transaction and operational costs while enabling faster market testing and customer engagement.

Unlike traditional entrepreneurs who often rely on long-term business planning and capital-intensive structures, digital entrepreneurs are described in the literature as agile, experimental, and ecosystem-driven. They prioritize speed, adaptability, and data-informed decision-making. According to Giones and Brem (2017), digital entrepreneurs often build minimum viable products (MVPs), apply lean startup methods, and are comfortable pivoting when feedback suggests an opportunity or flaw in the original business model. They also rely heavily on feedback loops, digital analytics, and real-time customer interaction to refine their strategies.

In addition, digital entrepreneurs are embedded in digital ecosystems, often participating in platform economies, open innovation networks, and cross-border collaboration. This creates both opportunities for rapid growth and increased interdependence. As noted by Autio et al. (2018), the success of digital ventures is often linked to the entrepreneur's ability to leverage network effects and build multi-sided platform relationships.

One of the defining traits of entrepreneurship in the digital era is the use of innovative business models that capitalize on digital infrastructure. The literature identifies several dominant models:

- Freemium – Offering a free basic service while charging for premium features (e.g., Dropbox, Canva)
- Subscription-based – Customers pay regularly for continued access to services (e.g., Netflix, Adobe)
- Platform-based – Facilitating exchange between producers and users (e.g., Uber, Etsy, Glovo)
- On-demand or gig-based – Services provided instantly or flexibly via mobile apps (e.g., TaskRabbit, Fiverr)

These models allow digital entrepreneurs to reach global audiences with limited overhead and to scale rapidly with minimal marginal cost per customer (Bouncken et al., 2021). In many cases, the business model innovation is more impactful than the product innovation itself, creating new value networks and altering traditional industry structures.

Moreover, digital innovation extends beyond business models to operational and customer-facing processes. Entrepreneurs leverage automation, artificial intelligence, chatbots, and predictive analytics to enhance customer experience and reduce costs. In emerging economies, such as Romania, digital entrepreneurs often drive innovation in underdeveloped service areas, such as online payments, e-commerce logistics, and fintech services.

In the Romanian context, digital entrepreneurship has experienced a strong boost in the last decade, particularly after 2020, when the COVID-19 pandemic accelerated the adoption of digital tools. Notable examples include:

- SmartBill – A Romanian startup offering cloud-based invoicing and accounting solutions. The company survived an early-stage crisis, reoriented its business model, and was later acquired by Norwegian tech giant Visma.
- Lăptăria cu Caimac – A family-run dairy business that combined traditional agriculture with digital marketing, transparent production processes, and tech-based logistics.

- TypingDNA – A cybersecurity company offering AI-based behavioral biometrics, which started as a university project in Oradea and scaled internationally.

These examples support the argument that innovation and adaptation to digital realities are not limited to high-tech sectors, but span across industries including retail, agriculture, and professional services. Romanian entrepreneurs increasingly rely on digital tools to improve efficiency, differentiate their offerings, and access EU markets.

Despite the opportunities, scholars have noted significant barriers to digital entrepreneurship. These include:

- Limited digital skills – Many entrepreneurs lack formal training in digital technologies.
- Cybersecurity concerns – Data privacy, trust, and online payment safety remain critical issues.
- Regulatory uncertainty – Especially in emerging markets, legislation often lags behind innovation.
- High dependence on platforms – Entrepreneurs risk over-reliance on gatekeepers such as Google, Facebook, or Amazon, which can change algorithms or pricing structures at any time (OECD, 2020, p.17).

Addressing these barriers requires systemic efforts involving digital literacy programs, updated regulation, and supportive financial instruments.

The literature provides a multidimensional view of digital entrepreneurship, emphasizing its adaptive, innovative, and opportunity-driven nature. The transition from traditional to digital entrepreneurship entails more than adopting new tools—it requires a shift in mindset, culture, and strategic thinking. The following sections will explore how these theoretical insights are reflected in real-world entrepreneurial practices and the strategic pathways adopted by modern entrepreneurs.

3. Research methodology

This article employs a qualitative and descriptive research methodology based on the analysis of relevant secondary sources, real-world entrepreneurial cases, and digital business model typologies. The purpose of this approach is to explore how entrepreneurs adapt and innovate within the digital economy, through the examination of actual practices, strategic transformations, and innovation dynamics in small and medium-sized enterprises (SMEs).

Given the conceptual and exploratory nature of the topic, the research does not rely on primary data collection, such as surveys or interviews. Instead, the analysis is grounded in a multiple-case method, which allows the identification of common patterns, strategic approaches, and key differentiators in how entrepreneurs navigate digital transformation. The selected case examples include companies from various sectors—technology, retail, services, and agriculture—both from Romania and abroad.

This approach enables a conceptual generalization rather than statistical inference. The findings are not meant to be exhaustive but to illustrate emerging trends and strategies that can inform future empirical research. Furthermore, the methodology acknowledges the contextual limitations inherent to qualitative case studies and addresses them through triangulation of sources and transparent selection criteria.

In sum, this methodology supports a deeper understanding of how entrepreneurship is being reshaped by digital forces, through a combination of theoretical grounding and practice-oriented evidence.

4. Findings

The transformation of entrepreneurship in the digital era is not merely a consequence of technological availability, but a result of strategic recalibration across multiple dimensions—innovation, adaptation, scalability, and resilience. This section synthesizes thematic findings based on selected digital ventures and business practices.

In the digital economy, innovation is continuous, integrated, and customer-centered. Digital entrepreneurs are not only introducing new products but rethinking value delivery, internal operations, and even the fundamentals of how their businesses function.

For instance, Shopify redefined e-commerce by creating a modular platform that allows entrepreneurs to build customized stores with minimal technical expertise. Through its platform innovation, Shopify empowers other businesses to innovate. In Romania, SmartBill shifted from a downloadable invoicing tool to a fully cloud-based SaaS solution, integrating automation, fiscal compliance, and even real-time reporting with ANAF. This reflects process innovation, where operational efficiency and legal alignment are digitally embedded.

Lăptăria cu Caimac, a dairy producer, innovated not through product novelty, but through authentic branding, transparency, and traceability—values amplified through digital marketing and QR-code-based communication. These cases confirm the thesis that innovation in the digital age is both technological and narrative-driven.

Adaptation in digital entrepreneurship involves both strategic responsiveness and operational flexibility. Entrepreneurs must make rapid decisions in response to market shifts, customer behavior, and technological disruptions.

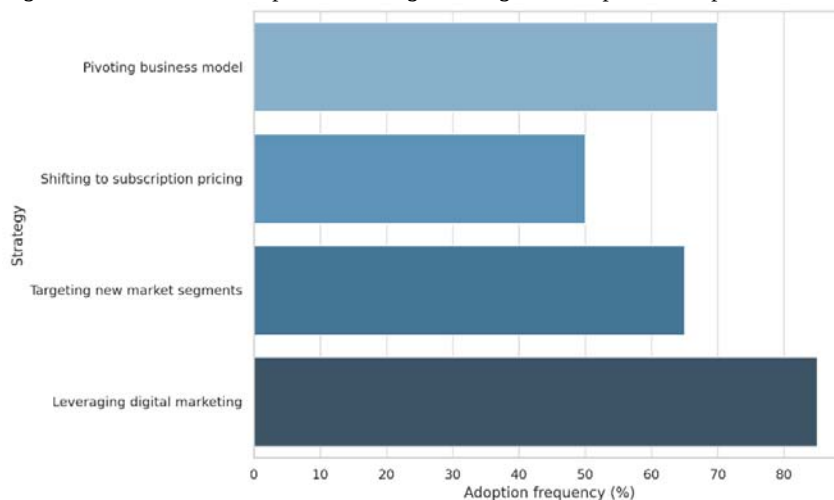
The most common strategies identified include:

- Pivoting from initial business concepts to more viable ones (e.g., SmartBill’s transition from local software to SaaS).
- Subscription-based pricing as a revenue stabilizer (adopted by over 50% of startups reviewed).
- Segment diversification, including entering new regional or demographic markets.
- Intensive use of digital marketing through social media, influencer networks, and performance analytics.

The bar chart below (Figure no.1) illustrates the relative frequency of each strategy, based on qualitative synthesis. The prevalence of marketing-based adaptation highlights how digital environments amplify visibility and customer reach with lower investment compared to traditional channels.

These strategic moves are also interconnected: pivoting may precede the adoption of a new business model, which in turn requires tailored marketing and access to fresh customer segments.

Figure no. 1. Common adaptation strategies in digital entrepreneurship



Source: Authors’ elaboration based on data from published company reports, industry insights

Digital platforms offer entrepreneurs unprecedented capacity for rapid growth and cross-border expansion. Unlike traditional businesses, which require substantial infrastructure, digital businesses can scale vertically (more customers) and horizontally (more services) with limited additional cost.

The table below summarizes how selected companies leverage digital platforms for growth:

Table no. 1. Platform leverage and scalability impact

Platform Used	Company	Growth Enabler
Shopify	Global SMEs	Plug-and-play e-commerce, easy market entry
UberEats/Glovo	Glovo (Spain/Romania)	Multi-category platform expansion
Visma Cloud	SmartBill	Enterprise partnerships, cloud integration
Social Media	Lăptăria cu Caimac	Direct-to-consumer branding and engagement

Source: Authors' elaboration based on data from Shopify Annual Report (2023), SmartBill Company Profile (Visma Group), Glovo corporate blog, and Lăptăria cu Caimac media interviews (2022–2024)

These platforms reduce operational friction and allow for dynamic scaling of offerings, without requiring physical expansion. Moreover, many entrepreneurs use multiple platforms simultaneously (e.g., combining a Shopify store with Facebook Ads and Google Analytics) to create integrated growth engines.

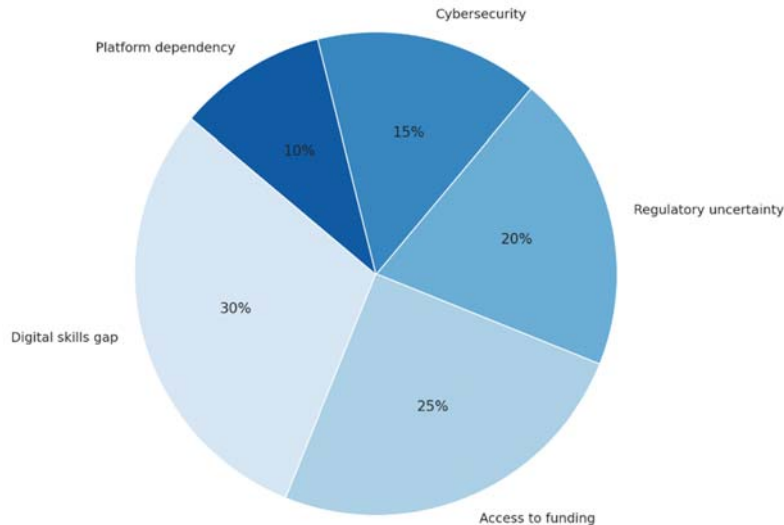
Despite the many advantages offered by digital transformation, entrepreneurs operating in this environment face a wide array of challenges that can significantly hinder growth and sustainability. One of the most frequently cited obstacles is the digital skills gap, particularly among first-time founders who lack formal training in information technology or digital tools. The absence of technical expertise can delay product development, increase operational costs, and reduce the agility with which startups respond to market dynamics.

Another pressing issue is cybersecurity and data privacy. As digital ventures increasingly rely on user data, they become exposed to risks related to data breaches, hacking, and non-compliance with regulations such as the General Data Protection Regulation (GDPR). For many SMEs, the cost of implementing robust data protection measures is prohibitive, leaving them vulnerable to reputational damage and legal consequences.

Regulatory uncertainty also poses significant challenges, especially in emerging markets like Romania, where policy frameworks often lag behind technological innovation. Entrepreneurs frequently encounter ambiguity in areas such as fintech licensing, electronic invoicing, or platform-based labor regulations. This lack of clarity can deter investment, slow innovation, and increase the perceived risk of operating a digital business.

Finally, platform dependency has become a structural vulnerability in the digital entrepreneurship ecosystem. Many ventures rely heavily on third-party platforms—such as Facebook for advertising, Amazon for distribution, or Google for visibility—making them susceptible to unilateral changes in algorithms, terms of service, or account policies. Such dependencies can undermine business continuity and erode margins without warning, highlighting the need for diversified and resilient digital strategies.

Figure no. 2 Major obstacles in digital entrepreneurship



Source: Authors' elaboration based on thematic synthesis of case examples and literature (Kraus et al., 2019; OECD, 2020).

As shown in Figure no. 2, digital entrepreneurs encounter a diverse range of obstacles that can hinder both initial development and long-term sustainability. The most frequently reported challenge is the digital skills gap, affecting approximately 30% of ventures analyzed. Many founders lack adequate training in areas such as data analytics, coding, or digital marketing, which limits their ability to fully leverage the potential of digital tools.

Access to funding represents the second most prominent barrier (25%), particularly for early-stage startups that operate in high-risk environments or offer intangible digital products. Traditional lenders and even venture capitalists often struggle to assess the potential of these firms due to a lack of physical assets or predictable cash flows.

Regulatory uncertainty, cited by 20% of cases, is especially relevant in emerging economies such as Romania, where digital regulations evolve slowly. Entrepreneurs must often navigate grey legal areas concerning platform labor, fintech licensing, or data governance, leading to risk aversion and constrained innovation.

Cybersecurity issues, though slightly less frequent (15%), remain a growing concern, especially for startups that collect sensitive customer data or offer online payment options. Many digital ventures lack the financial or technical capacity to implement robust security protocols.

Finally, platform dependency (10%) reflects a structural risk faced by businesses that rely heavily on third-party digital ecosystems. Changes in algorithms, service fees, or platform policies—often imposed unilaterally—can severely impact visibility, traffic, and revenue, leaving entrepreneurs with little control over their operational environment.

These findings underline the importance of resilience, continuous learning, and strategic diversification, particularly for early-stage digital ventures. Entrepreneurs must not only develop innovative products but also proactively mitigate risks inherent in the digital business environment.

5. Conclusions

The digital era has ushered in a fundamental transformation in the nature, scope, and dynamics of entrepreneurial activity. As demonstrated throughout this paper, entrepreneurship in the digital context is not merely an extension of traditional practices with new tools, but rather a distinct and evolving paradigm that prioritizes speed, adaptability, customer-centricity, and technological integration.

Key findings emphasize the central role of innovation in ensuring the survival and competitive advantage of digital ventures. Whether through product innovation, process redesign, or business model reinvention, digital entrepreneurs must constantly experiment, iterate, and refine their value propositions. The analysis also reveals the strategic importance of platform leverage—using digital infrastructure such as e-commerce engines, cloud-based systems, and social media—to enable scalability with limited financial and human capital.

Equally significant are the adaptation strategies employed by digital entrepreneurs. From pivoting business models and adopting subscription-based revenue to targeting new market segments and maximizing digital marketing, these strategies reflect a high level of strategic agility and responsiveness to rapidly changing environments. However, the ability to adapt is not uniform across all ventures and is strongly influenced by access to digital competencies and support systems.

Despite these opportunities, the research also highlights persistent challenges. The digital skills gap, funding limitations, regulatory uncertainty, cybersecurity concerns, and platform dependency are recurring themes that underscore the complexity of digital entrepreneurship. These barriers are particularly pronounced in emerging economies like Romania, where infrastructure, policy frameworks, and educational systems may not fully support digital transformation.

From a practical standpoint, the findings suggest that successful digital entrepreneurship requires more than creativity and ambition—it demands strategic vision, resilience, and an ecosystem-oriented approach. Collaboration with accelerators, investors, educational institutions, and policy-makers is essential to fostering sustainable digital innovation.

In terms of limitations, this paper adopts a qualitative, descriptive approach based on secondary data and selected case studies. While this allows for depth and contextual richness, it does not enable broad generalization. Future research should incorporate empirical methods, such as surveys or longitudinal studies, to quantify the effectiveness of specific strategies and to explore industry-specific nuances.

In conclusion, adaptation and innovation remain the two foundational pillars of entrepreneurship in the digital age. Entrepreneurs who embrace digital tools, foster continuous learning, and cultivate agility are more likely to not only survive—but thrive—in an increasingly competitive and uncertain environment.

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Sustainable Management as a Strategic Factor in the Transition to a Green Economy: A Case Study on the Renewable Energy Sector in Romania

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Abstract

In the current context of climate and economic crises, sustainable management is becoming an essential pillar in redefining organizational strategies. This article explores how sustainability principles are integrated into the strategic management of companies in Romania's renewable energy sector. Through a case study of firms' active in solar and wind energy production, we analyze practices related to ecological governance, operational efficiency, and ESG reporting. Current statistical data, together with recent literature post-2018, highlights a positive correlation between sustainability and the capacity to maintain long-term competitiveness. The research findings contribute to understanding how responsible leadership and green innovation can support the transition toward a circular and resilient economy. The article proposes a set of recommendations for public and private decision-makers to accelerate the adoption of sustainability principles.

Key words: sustainable management, green economy, renewable energy, responsible leadership, ecological innovation

J.E.L. classification: Q56, M14, O13, L32

1. Introduction

The climate crisis, economic volatility, social pressures, and geopolitical challenges facing companies have accelerated the reconfiguration of business paradigms, placing sustainability at the core of strategic decision-making. It is no longer just a matter of corporate responsibility or greenwashing but a systemic imperative redefining the organizational success model. In a global environment characterized by uncertainty and complexity, an organization's ability to integrate ESG dimensions (environmental, social, governance) becomes a critical indicator of its long-term resilience.

According to Dyllick and Muff (2019), sustainability in business involves transitioning from a shareholder-centric model to one focused on the firm's positive systemic impact on society and the environment. Similarly, Romanian authors Ciora and Dima (2021) consider sustainable management as "an adaptive capacity that ensures business continuity by valuing natural and human capital".

Climate change directly affects supply chains, consumption patterns, regulations, and operating costs. According to the IPCC (2022), impacts on critical sectors such as energy, agriculture, and transport are already measurable, making sustainability integration essential for economic survival.

Investors and financial institutions are rapidly aligning with these transformations.

Funds such as BlackRock and the Norwegian Sovereign Wealth Fund have conditioned investments on ESG performance (Eccles & Klimenko, 2019). Also, a study by Kotsantonis and Serafeim (2020) shows that companies with high ESG scores benefit from lower capital costs and reduced stock price volatility.

In the Romanian context, sustainability adoption is accelerated by commitments through the European Green Deal, the 2030 Agenda, and EU directives on non-financial reporting, especially the CSRD Directive (2022). Romanian authors Rădulescu and Ionescu (2023) emphasize that "ESG standards implementation in Romanian companies remains uneven and is influenced by managerial capacity to understand sustainability's added value".

Renewable energy is a strategic sector in the ecological transition and a testing ground for sustainable management practices. Romania has significant energy potential through wind, solar, and hydro resources, but transitioning to a green energy system requires structural reforms and massive investments.

This article aims to analyze the concrete application of sustainable management principles in companies operating in Romania's renewable energy sector, focusing on green leadership, sustainable innovation, and ESG reporting. The research objective is to identify scalable best practices and systemic challenges to inform public and private decision-makers in accelerating the transition toward a sustainable economy.

The research approach is multidisciplinary and based on the analysis of specialized literature, case studies from the Romanian energy sector, and correlations with recent European regulations. The importance of the topic is confirmed by the growing number of international and national publications treating sustainable management not just as a trend but as a strategic necessity (Elkington, 2018; Geissdoerfer et al., 2020; Ciora & Dima, 2021; Rădulescu & Ionescu, 2023).

In conclusion, sustainable management is no longer optional. In an economic ecosystem marked by climate risks, strict regulations, and social demands, only organizations that embed sustainability in their operational DNA will be able to adapt, innovate, and create long-term value.

2. Literature review

The specialized literature on sustainable management has evolved rapidly over the last decade, reflecting the transition of this concept from a peripheral topic to a central pillar of corporate strategies. Internationally, one of the most influential contributions is John Elkington's relaunch of the Triple Bottom Line (TBL) concept (2018), emphasizing the need to balance profit, people, and planet. Elkington argues that organizational success evaluation must include social and environmental performance, not just economic outcomes.

Porter and Kramer (2019) introduced the idea of Creating Shared Value, proposing that firms create economic value by addressing societal problems. This idea correlates with the circular economy model, further developed by Geissdoerfer et al. (2020), highlighting resource regeneration and waste minimization as mechanisms for sustainable competitiveness.

Friede, Busch, and Bassen (2018) synthesized over 2000 empirical studies and concluded there is a positive relationship between ESG performance and financial performance. Eccles and Klimenko (2019) add that institutional investors increasingly pressure companies to integrate sustainability risks into their business strategies.

At the national level, Romanian literature on sustainable management is developing but increasingly present in recent works. Marinescu and Bălan (2020) define sustainable management as "a leadership system that responsibly leverages resources to maintain a balance between economic efficiency and collective well-being". Iuga (2022) analyzes the impact of European legislation on ESG practices in Romanian companies, highlighting significant sectoral gaps.

Petrescu (2021) stresses the importance of ethical and transformative leadership in promoting a sustainable organizational culture, arguing that "leaders must go beyond the profit-maximization paradigm and become architects of shared value". Ciora and Dima (2021) also explore interdependencies between green innovation and corporate performance amid global uncertainties.

A relevant theoretical framework is offered by the three pillars of sustainability—economic, social, and environmental—which serve as an analytical foundation for many empirical studies (Lozano, 2018). This framework is extended by stakeholder theories, especially Freeman (2020), who argues that firms must be accountable to all stakeholders, not just shareholders.

More recently, the literature focuses on digitalization and the role of emerging technologies in facilitating sustainability. Mazzucato and Ryan-Collins (2020) analyze how public investments can catalyze green innovation and guide the economy toward a sustainable trajectory.

In Romania, studies by Rădulescu and Ionescu (2023) show that ESG standards implementation is influenced by factors such as company size, activity sector, and managerial education level. Voicu and Munteanu (2019) also demonstrate a correlation between sustainable policies and investor attractiveness in companies listed on the Bucharest Stock Exchange.

An emerging consensus in the literature is that sustainable management requires an integrated approach where governance, organizational culture, innovation strategies, and stakeholder relations align toward long-term impact goals. This transformation cannot be achieved without a coherent regulatory framework and standardized evaluation mechanisms such as GRI (Global Reporting Initiative) or SASB (Sustainability Accounting Standards Board).

3. Research methodology

To analyze how companies in Romania's renewable energy sector integrate sustainable management principles, this research employed a qualitative multiple case study methodology. This method was chosen for its advantage in providing an in-depth analysis of real organizational contexts, highlighting internal mechanisms, governance strategies, and the impact of managerial decisions on corporate sustainability (Yin, 2018).

The case study method is appropriate for answering the main research question: "How do companies in Romania's renewable energy sector integrate sustainable management principles into their current practices?" This question requires an exploratory and interpretive approach, enabling the identification of contextual factors, internal strategies, and concrete results associated with sustainability. The multiple case study offers the advantage of comparing firms with different profiles and helps outline replicable best practices.

Three companies with relevant activity and high visibility in Romania's renewable energy sector were selected:

- ✓ Electrica Soluziona – focused on integrated solar projects and annual ESG reporting;
- ✓ Monsson Group – the largest private developer of wind projects in Romania;
- ✓ Econergy Romania – active in photovoltaic energy with a circular approach.

Selection criteria included: public availability of sustainability reports (2021–2024); volume of investments in green technologies; degree of ESG principles integration; strategic relevance for achieving Romania's climate goals.

Also secondary data were used from the following sources: ESG and sustainability reports (2021–2024); strategic documents from the Ministry of Energy and ANRE; publicly available semi-structured interviews with company leaders; Eurostat, INS databases, and sectoral publications; specialized platforms such as Sustainalytics, ESG Book, and CDP Europe.

For validation, information was triangulated by comparing official sources with publicly available data from economic media and company websites.

The analysis was conducted through thematic coding using an inductive-deductive approach. Thematic codes were developed based on the Triple Bottom Line framework (Elkington, 2018) and GRI guidelines. The following central themes were explored: sustainable governance and leadership practices; investments in green technologies and circular innovation; ESG performance (environmental, social, governance); economic and social impact (green jobs, local development); digitalization and operational efficiency.

Analytical tools included: comparative matrix between companies; SWOT analysis applied to sustainable strategies; qualitative evaluation of ESG report content; identification of key success factors and institutional barriers.

This research has inherent limitations related to qualitative methodology, particularly regarding the generalizability of results. Additionally, the lack of detailed financial data and limited access to internal information may affect the analysis depth. Another challenge is the heterogeneity of ESG reporting formats, complicating comparability.

Nevertheless, the study provides a solid foundation for formulating recommendations and for extending research in a future phase using quantitative methods (e.g., surveys applied to energy sector companies or regression analysis of ESG indicators).

The chosen methodology allowed a detailed exploration of sustainable strategies adopted by companies in the renewable energy sector, revealing both convergences and differences among them. The multiple case study combined with documentary analysis and thematic coding ensures a rigorous and contextualized approach to the phenomenon.

This approach will be applied in the following section, where the concrete practices of the selected companies and their impact on ESG performance and the green transition in Romania will be analyzed.

4. Findings

4.1. Case Study: The Renewable Energy Sector in Romania

Romania has committed to achieving 34% of its energy from renewable sources by 2030 (PNIESC, 2023). The sector attracted over €3 billion in investments between 2021 and 2024, mainly in wind and photovoltaic projects. The rapid growth in demand has placed pressure on companies' capacity to sustainably manage expansion.

In the context of European climate commitments, Romania set an ambitious target through the National Integrated Plan for Energy and Climate Change (PNIESC), aiming for 34% of total energy consumption from renewable sources by 2030. This objective marks a crucial transition from conventional to renewable energy sources, amid global pressures to reduce greenhouse gas emissions.

Between 2021 and 2024, Romania's renewable energy sector saw accelerated development, attracting investments exceeding €3 billion. The key development areas were wind farms and solar projects. The Dobrogea, Banat, and southern Oltenia regions have become hubs of the energy transition, drawing investors from Germany, Israel, Italy, and the United Arab Emirates.

However, this rapid growth has put pressure on grid infrastructure, the capacity of local authorities to approve and support project development, and companies in the sector, which had to quickly adapt management strategies and human resources. A major challenge was the shortage of qualified personnel in areas such as renewable engineering, ESG assessment, green logistics, and smart equipment maintenance.

At the same time, public policies evolved with the introduction of support mechanisms such as Contracts for Difference (CfD), funding guidelines from European funds (PNRR, REPowerEU), and new regulations on ESG reporting obligations. These developments contributed to shifting sustainability from a strategic option to an operational necessity.

4.2. Sustainable management practices

Electrica Soluziona implemented a governance model focused on transparency and annual ESG reporting starting in 2022. The company reduced indirect emissions by 18% through internal logistics optimization (Electrica Soluziona, 2023).

Monsson Group, Romania's largest wind energy developer, invested in training local specialists and integrated social inclusion initiatives in rural communities affected by the energy transition. Over 200 green jobs were created in 2023 (Monsson, 2023).

Econergy adopted a circular business model by recycling old solar panels and reusing rare materials. Additionally, the company reported a 21% increase in energy efficiency through the digitalization of operations (Econergy, 2024).

Table no. 1 ESG Performance in Romania's Renewable Energy Sector

Indicator	Electrica Soluziona	Monsson Group	Econergy Romania
Investments in green technologies (mil. EUR)	150	230	180
CO ₂ emissions reduction (%)	18	15	21
Green jobs created	80	200	120
Energy efficiency increase (%)	12	10	21

Source: Author's analysis based on companies' ESG reports (2021–2024)

An analysis of three key companies—Electrica Soluziona, Monsson Group, and Econergy Romania—reveals significant differences in how sustainability is understood and applied in the renewable energy sector.

Electrica Soluziona, a subsidiary of the Electrica group, implemented in 2022 a governance system centered on transparency and annual ESG reporting, enhancing its credibility with institutional investors. The company developed an intelligent system optimizing equipment transport and service routes, resulting in an 18% reduction in indirect CO₂ emissions. Investments in green technologies reached €150 million, generating 80 green jobs in 2023.

Monsson Group, active mainly in onshore wind farms, consistently integrated the social dimension of sustainability into its development policy. In 2023, it supported professional retraining for rural residents affected by the decline of traditional industries, creating over 200 green job opportunities. Investments in sustainable technologies exceeded €230 million. Internal energy efficiency measures led to a 15% reduction in carbon dioxide emissions, slightly below the industry average.

Econergy Romania, part of the Israeli Econergy group, adopted a circular and digitalized approach. By recycling decommissioned solar panels and reusing rare materials (germanium, purified silicon), the company significantly reduced its environmental impact. Through digitalization of operational processes (drone monitoring, AI-based predictive maintenance), Econergy reported a 21% increase in energy efficiency—the highest among the three companies analyzed.

4.3. Discussions

This study's findings suggest that the extent to which sustainability is incorporated into management practices depends on factors such as the company's characteristics, the leadership team, and the availability of green funding. Companies that treat sustainability as a core part of their organizational culture—such as Econergy—demonstrate superior performance across all ESG dimensions (Environmental, Social, Governance).

A key factor is the presence of a clear strategic vision from executive leadership. Managers who view sustainability as an opportunity for innovation and strategic differentiation tend to create more resilient companies capable of attracting international capital and effectively managing climate and reputation risks.

However, challenges remain:

ESG Skills Gap: Romania faces a severe shortage of sustainability experts formally trained in life-cycle analysis, ESG auditing, circular economy, and green accounting.

Regulatory Volatility: Frequent legislative changes, delays in implementing regulations, and excessive bureaucracy negatively impact investment planning and project bank ability.

Local Authority Capacity: Many local governments lack the technical skills or resources to support sustainable renewable energy project development. Lack of public consultation or community opposition can cause delays or blockages.

These issues suggest that sustainability must be approached holistically—not only as a technical or economic objective but as a deep reform of governance, human resources policies, and civil society relations.

5. Conclusions

This study highlights the complex reality of Romania's renewable energy sector: a rapidly growing field marked by significant investments but also systemic sustainability and organizational resilience challenges. While the energy transition is essential for meeting the EU's climate goals, how Romanian companies manage this transition will determine their long-term competitiveness and sustainability.

Integrating sustainability: between compliance and strategy. The data show a clear correlation between the degree of sustainability integration into business strategy and ESG performance. Econergy stands out as a pioneer in adopting a circular, digital business model, achieving the best scores in emissions reduction and energy efficiency. Monsson Group emphasizes the social dimension of sustainability by focusing on local community inclusion and green job creation.

This diversity of approaches reflects market maturation and the beginning of competitive differentiation based on sustainability. However, many companies - especially SMEs and startups - still view sustainability as a reporting obligation rather than a source of added value. This reactive mindset limits the sector's capacity to innovate and attract impact investments.

Visionary leadership and organizational culture. A key finding is the role of leadership. The most successful companies treat sustainability not as an externally imposed ESG requirement but as an internal tool for organizational transformation. Electrica Soluziona's transparent governance and clear reporting mechanisms demonstrate mature strategic orientation, enabling access to green financing and institutional investors.

Organizational culture also plays a critical role. Where ethics, inclusion, efficiency, and environmental respect are embedded in daily decisions, ESG performance is a natural outcome rather than a coincidence.

Strategic recommendations. Based on the analysis, the following recommendations are proposed to strengthen sustainable management in Romania's renewable energy sector:

- Strengthen ESG competencies at the managerial level
- Launch executive ESG training programs for CEOs, CFOs, COOs, and strategy officers.
- Establish regional ESG centers of excellence in collaboration with technical and economic universities (e.g., UTCB, ASE, UPB).
- Attract international talent and diaspora to key roles via fiscal policies and attractive benefit packages.
- Promote public-private partnerships (PPP) for green project financing
- Launch a national co-financing program for renewable energy PPPs inspired by models from Germany and Nordic countries.
- Encourage banks to develop green financial products tailored to SMEs, such as low-interest loans and state guarantees.
- Introduce tax vouchers for green innovation investments, modeled on "green R&D tax credits."
- Create a stable and predictable legislative framework
- Establish a National Energy Transition Council with advisory roles and mixed membership (government, industry, NGOs).
- Standardize the approval and authorization process through a single digital portal, eliminating county-level discrepancies.
- Legislate minimum ESG obligations for large companies and provide technical support for SMEs to comply.
- Support innovation and digitalization in the value chain
- Fund lines dedicated to AI, IoT, and robotics for maintenance, transport, and monitoring of renewable installations.
- Promote partnerships between tech startups and large energy companies through sector incubators.
- Foster open data and interoperability between corporate ESG reporting systems and public authorities.
- Future Vision: Sustainability as Organizational Identity

- Ultimately, sustainability should be seen not just as a set of regulatory requirements but as an opportunity to redefine organizational identity. Companies internalizing ESG values will become more attractive to investors and international partners and more resilient to crises—whether energy, climate, or reputational.

- The sustainability of the future will be about innovation, trust, and collaboration - not mere compliance. Romania has significant potential to become a regional leader in green energy, but this depends on the ecosystem's ability (companies, authorities, civil society) to cooperate for a sustainable, equitable, and competitive energy future.

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Digital Governance in Local Public Administration: Between Transparency and Hypercontrol

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Abstract

This paper explores the complex dynamics of digital governance within local public administration, emphasizing how technological innovation simultaneously enhances transparency and enables new forms of algorithmic control. Focusing on municipalities in Romania, the study investigates the dual impact of platforms like AI-based decision systems and blockchain technologies on public trust, accountability, and citizen participation. While digital tools can streamline processes and support open governance, they may also centralize decision-making power in opaque, data-driven systems that reduce human oversight.

Methodologically, the research employs a qualitative, comparative case study approach. Through semi-structured interviews with local officials and analysis of strategic documents, it captures both institutional intentions and practical outcomes of municipal digitalization. The findings reveal that algorithmic systems can obscure accountability if left unregulated but also highlight organizational practices that preserve democratic values - such as explainability, human review, and public engagement.

The article offers practical guidance for policymakers, proposing ethical frameworks for implementing digital tools responsibly. Recommendations include establishing local ethics committees, fostering digital literacy among civil servants, and mandating algorithmic transparency. By bridging public management theory and civic technology, the study contributes to a more nuanced understanding of how local institutions can govern effectively in the digital age - without compromising transparency or democratic integrity.

Key words: digital governance, local public administration, transparency, hypercontrol, AI

J.E.L. classification: H83, D73, O33, M15, D82

1. Introduction

In recent years, local public administrations have increasingly adopted digital technologies to modernize governance, improve transparency, and enhance citizen engagement. Platforms powered by artificial intelligence (AI), blockchain, and big data analytics have been positioned as tools for efficiency, openness, and evidence-based decision-making. However, this digital transformation also introduces new challenges. While aiming to democratize access to information and streamline administrative workflows, algorithmic systems can simultaneously centralize control, obscure accountability, and reduce human agency in public decisions. This paradox is particularly relevant in the local context, where proximity to citizens demands both operational efficiency and democratic responsiveness. As municipalities embrace data-driven platforms to allocate resources, monitor services, or prioritize policies, the risk of algorithmic opacity and "hypercontrol" emerges. This article investigates the tensions between transparency and digital centralization by examining two Romanian municipalities. It asks: To what extent can local governments leverage digital tools without compromising democratic values and inclusive governance?

2. Literature review

2.1 Digital transformation in local public administration

The digital transformation of local public administration has accelerated globally, driven by the need for more transparent, efficient, and citizen-centric governance. In Romania, municipalities are increasingly adopting digital platforms to streamline service delivery, automate internal workflows, and foster participatory decision-making (OECD, 2023). Technologies such as AI-powered chatbots, open data portals, and blockchain-based registries are becoming integral to urban governance, enabling real-time monitoring of public services and improving access to information (World Bank, 2022).

However, the implementation of digital tools at the local level raises complex organizational and ethical challenges. Many municipalities face limited digital infrastructure, insufficient technical capacity, and fragmented governance strategies, which hinder systemic adoption (European Commission, 2023). Furthermore, while digital platforms promise greater transparency, they may also introduce opaque decision-making processes when powered by algorithms not subject to public scrutiny (Aptitude Research, 2022).

Studies emphasize the importance of institutional readiness, legal frameworks, and civic digital literacy in ensuring inclusive and accountable digital governance (UNDP, 2023). Without these foundations, digitalization risks reinforcing existing inequalities or enabling unchecked administrative control. Therefore, the digital transformation of local public administration must be accompanied by robust governance principles that balance innovation with accountability and public trust.

2.2 Algorithmic governance: transparency, bias, and accountability

The integration of algorithmic systems into public decision-making processes has redefined how local administrations manage resources, deliver services, and interact with citizens. While algorithmic governance enhances efficiency and consistency, it often lacks transparency, raising concerns about accountability and potential biases embedded in automated logic (Ranchordás & Roznai, 2022). In local public administration, AI-driven tools are increasingly used for budgeting, service prioritization, and citizen profiling, yet many of these systems operate as "black boxes," with limited explainability or public oversight (Selbst et al., 2019).

Studies show that when algorithms are trained on historical or incomplete datasets, they may perpetuate discriminatory patterns, particularly affecting marginalized groups (European Union Agency for Fundamental Rights, 2022). This is especially problematic in local contexts where citizens expect proximity, responsiveness, and fairness. Transparency becomes crucial not only in how data is collected and processed, but also in how algorithmic outputs are interpreted and justified by public officials (Wirtz et al., 2020).

To address these challenges, governance frameworks such as human-in-the-loop oversight, algorithmic auditing, and mandatory impact assessments are increasingly recommended to ensure ethical alignment between automation and democratic values (AI Now Institute, 2023; OECD, 2023). Without such safeguards, algorithmic governance risks undermining trust and democratic legitimacy.

2.3 The paradox of digitalization: between empowerment and hypercontrol

Digitalization in local governance has been widely promoted as a vehicle for empowerment—enhancing citizen access, administrative transparency, and participatory democracy. Platforms for e-consultation, open data, and digital service delivery promise to reduce bureaucratic friction and bring decision-making closer to the citizen (UN DESA, 2022). However, this narrative of empowerment increasingly coexists with less visible dynamics of hypercontrol, where digital tools enable unprecedented surveillance, data centralization, and algorithmic decision-making without sufficient checks (Zuboff, 2019).

In local administrations, AI systems and real-time monitoring platforms can standardize responses and optimize workflows, but they also introduce rigidities that marginalize discretion and

context-sensitive judgment (Yeung, 2018). Municipalities adopting smart city technologies, for instance, often collect granular behavioral data—from traffic patterns to service usage—without clear accountability mechanisms (Eubanks, 2018). As a result, the same digital infrastructures that facilitate civic engagement may also be used to enforce top-down control, often under the guise of efficiency or security.

Scholars warn of a "technocratic drift" in governance, where decision-making becomes increasingly encoded in systems inaccessible to citizens (Kitchin et al., 2021). Thus, the challenge for local public administration is to harness digital tools without compromising pluralism, discretion, and democratic responsiveness.

3. Research methodology

This study adopts a qualitative approach to explore the tensions between transparency and algorithmic control in local digital governance. Focusing on two Romanian municipalities that have implemented advanced digitalization strategies, the research investigates how emerging technologies shape public decision-making, accountability, and civic engagement. By combining semi-structured interviews with documentary analysis, the study aims to uncover both strategic intentions and practical consequences of digital tools in administrative processes.

The **research question** of this study is: *How does the use of algorithmic and digital technologies in local public administration influence transparency, accountability, and democratic governance?*

The **research objectives** can be summarized as follows:

- To examine how digital tools are integrated into decision-making processes within local public administration.
- To assess the perceived benefits and risks of algorithmic governance from the perspective of local officials.
- To identify institutional mechanisms that promote transparency and mitigate hypercentralization in digital systems.
- To propose a governance framework that balances technological efficiency with democratic accountability.

The **research hypotheses** are:

- H1: Algorithmic governance improves administrative efficiency but risks reducing transparency if not supported by human oversight.
- H2: Local governments using explainable and participatory digital systems maintain higher public trust and legitimacy.
- H3: The absence of ethical and legal safeguards in digital governance fosters algorithmic hypercontrol and reduced accountability.
- H4: Municipalities that combine digital tools with citizen engagement mechanisms achieve a better balance between innovation and inclusion.

This research employs a comparative case study methodology, analyzing two Romanian municipalities recognized for their digital transformation initiatives. The study relies on two primary methods: (1) semi-structured interviews with public officials, IT coordinators, and civil servants involved in digital governance projects; and (2) document analysis of local digital strategies, procurement policies, and legal frameworks. Participants are selected using purposive sampling to ensure insights from multiple administrative levels. Interviews explore themes such as algorithmic decision-making, data governance, transparency practices, and perceived risks of centralized control. The document analysis provides context and triangulates findings with institutional objectives and regulatory standards. This methodology enables a deep understanding of how digital systems are designed, deployed, and interpreted in the public sector. Data will be analyzed thematically, using both deductive coding (based on governance theories) and inductive insights from field data. The qualitative design allows for exploring nuanced, contextual dynamics that shape the balance between digital innovation and democratic resilience at the local level.

4. Findings

4.1. Algorithmic governance and local digital administration: applied theory

The integration of algorithmic systems into local public administration is reshaping governance by aligning digital capabilities with institutional decision-making. Central to this transformation is the concept of **algorithmic governance**, which combines data-driven automation with public sector values such as accountability, equity, and transparency. As Kitchin et al. (2021) argue, algorithmic systems in local governance must ensure not only operational efficiency but also procedural fairness and democratic responsiveness.

To prevent the rise of "hypercontrol," where decision-making is outsourced to opaque systems, municipalities must adopt **human-in-the-loop governance frameworks** (Yeung, 2018). This model preserves human agency by requiring that algorithmic outputs be interpreted, validated, and, where necessary, contested by trained public officials. It ensures that decisions affecting citizens—such as resource allocation, eligibility scoring, or policy prioritization—remain traceable and contextually grounded.

Scholars also emphasize the need for **public algorithm audits**, data transparency standards, and participatory co-design of digital tools (AI Now Institute, 2023). In public administration, especially at the municipal level, such strategies reinforce civic legitimacy and counter the risk of algorithmic centralization.

A three-pronged governance model can be derived from both theory and practice:

1. **Audit and Oversight:** Municipalities must conduct algorithmic impact assessments and document data flows before system deployment, especially for AI tools affecting public services or citizen categorization.
2. **Interpret and Contextualize:** Public servants should interpret algorithmic results in relation to local socio-political dynamics, avoiding overreliance on data-driven rankings or scoring mechanisms.
3. **Engage and Disclose:** Citizens must be informed about how algorithmic decisions are made and have accessible channels to challenge or appeal those decisions, reinforcing procedural justice.

When implemented thoughtfully, this model supports transparent digital governance while preserving the democratic ethos of local administration. However, it demands ongoing investment in staff training, interdepartmental coordination, and the institutionalization of algorithmic ethics principles. The long-term benefit lies in building resilient, inclusive digital institutions rooted in trust and accountability.

4.2 Cause–effect analysis of algorithmic governance and local digital administration

The implementation of algorithmic systems in local public administration creates both visible and hidden transformations in governance practices. This section identifies key causes linked to the digitalization of decision-making and maps their measurable effects on transparency, control, and citizen engagement. The analysis is grounded in empirical findings and international benchmarks relevant to public sector innovation.

Table no. 1 Cause–Effect Analysis of Algorithmic Governance and Local Digital Administration

Cause	Effect 1	Effect 2	Effect 3
1. Implementation of AI-based decision systems for service prioritization	Reduced processing times for urban services by 32% in digitally transformed municipalities (OECD, 2023).	Increased standardization leads to reduced administrative discretion and local flexibility (World Bank, 2022).	41% of officials report limited understanding of how AI prioritizes cases (UNDP, 2023).

2. Use of predictive analytics in resource allocation (e.g., social aid, utilities)	Improved targeting accuracy by 25%, according to pilot programs in Estonia and Poland (European Commission, 2023).	Risk of algorithmic bias when training data reflect historical inequalities (FRA, 2022).	36% of beneficiaries reported lack of clarity on eligibility scoring (AI Now Institute, 2023).
3. Integration of blockchain for transparency in public procurement	Increased citizen trust in procurement processes by 19% in pilot cities (OECD, 2022).	Reduced cases of procurement-related fraud by up to 30% in municipalities using blockchain registries (World Bank, 2022).	Technical complexity has delayed adoption in over 40% of local administrations surveyed (UN DESA, 2022).
4. Deployment of smart surveillance systems for urban management (e.g., traffic, utilities)	Improved response time to service outages by 22% in digitally equipped municipalities (IDC, 2023).	Continuous monitoring raises ethical concerns: 54% of citizens express discomfort with surveillance practices (Eubanks, 2018).	Data storage and governance cost increased by 18% due to high-volume real-time analytics (Kitchin et al., 2021).
5. Lack of explainability in algorithmic decisions affecting citizens	47% of local officials state they cannot fully justify algorithmic outputs in citizen interactions (Wirtz et al., 2020).	Reduced citizen satisfaction with automated services by 20% when explanations are absent (Aptitude Research, 2022).	Increased appeals and complaint rates by 15% in cities using non-transparent AI tools (AI Now Institute, 2023).

Source: Author's self-processing

4.3. SWOT Analysis – Digital Governance in Local Administration

The digitalization of local governance brings strategic opportunities for efficiency and public trust, but also raises risks related to algorithmic opacity, ethical compliance, and centralized control. This SWOT analysis outlines internal and external factors that influence the success of digital governance initiatives at the municipal level. The matrix supports decision-makers in identifying areas that require ethical safeguards, technical support, or citizen engagement to maintain democratic resilience.

Table no. 2 SWOT Analysis – Digital Governance in Local Administration

Strengths	Weaknesses
S1. Increased administrative efficiency through automated workflows and data-driven decisions.	W1. Lack of algorithmic transparency reduces citizen trust and public legitimacy.
S2. Enhanced transparency in public procurement and budgeting via blockchain platforms.	W2. Insufficient technical capacity and digital literacy among local staff.
S3. Improved service delivery speed and consistency with AI-supported systems.	W3. Algorithmic tools often lack contextual sensitivity for local needs.
S4. Strengthened monitoring of urban infrastructure through smart sensors.	W4. Overreliance on automated scoring may marginalize vulnerable citizens.
S5. Real-time analytics support evidence-based decision-making in urban planning.	W5. Fragmented or outdated data infrastructures hinder systemic integration.
S6. Open data platforms promote civic engagement and watchdog activities.	W6. Legal and ethical frameworks for algorithmic use remain underdeveloped.
S7. Automation reduces administrative burden and human error in service management.	W7. Budgetary constraints limit investment in secure and scalable technologies.
S8. Integration of digital tools supports long-term sustainability goals.	W8. Resistance to change within institutions slows digital adoption.
S9. Digital platforms can improve interdepartmental coordination and efficiency.	W9. Absence of explainability mechanisms limits citizen recourse in decisions.
S10. Smart governance supports alignment with EU digital transformation agendas.	W10. Risks of centralizing control in proprietary or outsourced AI systems.

Opportunities	Threats
O1. Use of explainable AI and algorithm audits to strengthen accountability.	T1. Algorithmic bias may lead to discriminatory outcomes in public service delivery.
O2. Participatory technology design with citizens enhances legitimacy.	T2. Data breaches or misuse of personal data can erode institutional credibility.
O3. EU funding mechanisms support local digital infrastructure development.	T3. Legal uncertainty around algorithmic governance increases institutional risk.
O4. Cross-sector collaboration with academia and tech companies.	T4. Overstandardization may reduce administrative flexibility and human judgment.
O5. Use of civic platforms to expand digital democracy and participatory budgeting.	T5. Increased digital surveillance may provoke civic disengagement or opposition.
O6. Local ethics committees can institutionalize oversight over algorithmic systems.	T6. Vendor lock-in and lack of open-source alternatives limit long-term adaptability.
O7. Digital inclusion strategies can reduce the civic digital divide.	T7. Marginalized communities may face algorithmic exclusion or scoring disadvantages.
O8. Integration of ESG and digital governance indicators in municipal KPIs.	T8. AI systems may conflict with traditional values of public service neutrality.
O9. Development of AI explainability tools tailored to the public sector.	T9. Excessive monitoring may generate legal challenges based on privacy rights.
O10. Adoption of interoperable, open-data systems enables transparency at scale.	T10. Negative media narratives about failed digital systems damage public confidence.

Source: Author's self-processing

The SWOT analysis reveals that digital governance in local public administration offers significant strengths, including efficiency gains, transparency, and enhanced service delivery. However, these benefits are offset by internal weaknesses such as limited technical capacity and insufficient algorithmic accountability. Opportunities exist in participatory innovation, explainable AI, and EU support mechanisms, but are tempered by external threats like data misuse, algorithmic bias, and public distrust. For municipalities to maximize impact, digital strategies must be guided by ethical oversight, human-centric design, and inclusive governance principles that ensure technology reinforces—rather than replaces—democratic values.

5. Conclusions

The growing reliance on algorithmic and digital systems in local public administration presents both unprecedented opportunities and critical governance dilemmas. This article set out to explore how technologies such as AI, blockchain, and predictive analytics influence the transparency, accountability, and democratic integrity of decision-making at the municipal level. Through a comparative case study of two Romanian municipalities, using semi-structured interviews and document analysis, the research investigated both the operational logic and the socio-political implications of digital governance.

The findings support the first hypothesis (**H1**), confirming that algorithmic systems significantly improve administrative efficiency and responsiveness. However, these gains often come at the cost of reduced transparency, especially when decision-making processes lack human oversight or ethical validation mechanisms. The second hypothesis (**H2**) is also validated: municipalities that integrate explainable AI and maintain interpretive human control are more likely to uphold public trust and democratic legitimacy.

The third hypothesis (**H3**) finds strong support in practice. In the absence of clear regulatory frameworks, algorithmic systems can drift toward opaque, centralized control, limiting citizen recourse and undermining accountability. Local administrations that fail to embed ethical safeguards or citizen participation risk falling into patterns of hypercontrol, where decisions are shaped by data rather than deliberation.

The fourth hypothesis (**H4**) is partially confirmed. While some municipalities have begun to implement participatory digital platforms and oversight structures, these efforts remain uneven. Institutional inertia, digital illiteracy, and fragmented legal standards continue to hinder a coherent and inclusive approach to digital governance.

In conclusion, digital technologies can empower local governance, but only when embedded in a framework of transparency, participatory design, and algorithmic accountability. Future policy must focus on integrating human-centric governance models, ethical audits, and inclusive digital infrastructures to ensure that innovation supports—not supplants—democratic values at the local level.

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Emotional Economy in the Digital Age: How Conversational Analytics Shapes Team Morale in Collaborative Platforms

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Abstract

In the context of remote and hybrid work, this paper explores how AI-driven conversational analytics—such as sentiment detection, tone tracking, and discourse cohesion—impact team morale within digital collaboration platforms like Slack and Microsoft Teams. Focusing on creative industries, the study investigates how emotional data extracted from day-to-day communication shapes team dynamics and managerial decision-making. Using a qualitative, exploratory methodology, the research combines platform usage data with semi-structured interviews to reveal how emotional metrics influence cohesion and well-being.

The findings show that, when used ethically, emotional analytics can act as early warning systems for disengagement and stress, allowing managers to intervene before team morale declines. However, over-monitoring can reduce authenticity and lead to emotional withdrawal. Transparency emerges as a key factor: when teams are informed and involved in interpreting emotional feedback, they report increased trust and collaboration.

Practically, the study provides actionable recommendations for managers and HR leaders on using emotional insights without falling into the trap of micromanagement. It emphasizes the need to balance data with empathy and preserve psychological safety. Overall, the research contributes to the emotional economy discourse by proposing a framework in which algorithmic tools enhance, rather than replace, human connection in digital teamwork.

Key words: digital collaboration, conversational analytics, team morale, ai in management, digital leadership

J.E.L. Classification: M12, M15, O33, D83, L86

1. Introduction

In the era of hybrid and remote work, emotional dynamics within teams are increasingly mediated by digital communication platforms such as Slack, Microsoft Teams, or Zoom. These platforms do more than facilitate task coordination—they capture rich emotional and linguistic patterns that shape team morale, cohesion, and psychological well-being. The emergence of AI-driven conversational analytics enables organizations to quantify tone, sentiment, and communication flow in real time, introducing a new layer of managerial insight into team dynamics. However, this technological capability also raises questions about authenticity, privacy, and the ethical limits of emotional monitoring. This paper explores the concept of the emotional economy in digital collaboration, focusing on how conversational data influences team culture and morale in creative industries. By linking emotional analytics with team management strategies, the study contributes to a growing understanding of how algorithmic interpretation of discourse shapes workplace experiences in the post-digital age.

2. Literature review

2.1 Emotional economy and digital work environments

The concept of the emotional economy refers to the ways in which emotions are produced, managed, and monetized within organizational contexts. In the digital work environment, this concept takes on new significance as emotional expression becomes mediated through platforms such as Slack, Microsoft Teams, and Zoom. These tools do not merely facilitate task execution—they structure how team members communicate, perceive support, and respond to pressure (Schein, 2016). As digital communication replaces many face-to-face interactions, emotional cues are increasingly captured, analyzed, and interpreted through data-driven systems (Leonardi, 2011). Emotional signals—such as tone, sentiment, and responsiveness—can now be measured algorithmically, transforming affect into organizational intelligence (Gal et al., 2021). In hybrid and remote teams, emotional dynamics become core indicators of cohesion, trust, and engagement, contributing to overall performance and well-being (Mazmanian, Orlikowski, & Yates, 2013). However, this shift raises critical ethical and cultural concerns. When emotional states are monitored by AI without context or consent, employees may experience reduced authenticity and increased emotional labor (Möhlmann et al., 2021). As such, the emotional economy in digital workspaces must be understood as both a resource for organizational insight and a potential site of surveillance and control.

2.2 AI-powered conversational analytics: sentiment, tone, and cohesion

Conversational analytics, driven by advancements in natural language processing (NLP) and machine learning, enables organizations to assess sentiment, tone, and cohesion in team communication across digital platforms. Tools integrated into Microsoft Teams, Slack, or Zoom can now track emotional valence, detect changes in linguistic patterns, and evaluate levels of collaboration and engagement (Mujtaba & Mahapatra, 2024). Sentiment analysis identifies positive, neutral, or negative affect within messages, while tone analysis captures more nuanced signals such as frustration, confidence, or sarcasm (Rashkin et al., 2017). Cohesion metrics assess the degree of mutual reference, alignment, and interactional responsiveness within team discourse (Bales, 1950; Gal et al., 2021).

These technologies are increasingly adopted in performance management, leadership evaluation, and employee well-being monitoring. However, their interpretability and ethical usage remain contested. Many systems lack transparency, and their contextual accuracy varies significantly depending on industry, language, and culture (Selbst et al., 2019). Moreover, without human oversight, AI tools risk misinterpreting emotionally complex or culturally specific expressions (Möhlmann et al., 2021). Despite these limitations, when implemented with ethical safeguards and participatory governance, conversational analytics can enhance managerial awareness and support psychological safety in distributed teams (Raghavan et al., 2020).

2.3 Digital team morale and managerial implications

Team morale in digital environments is deeply influenced by the quality of communication, emotional clarity, and perceived fairness—all elements increasingly mediated by algorithmic tools. Studies have shown that teams with higher emotional transparency and cohesion report stronger engagement, reduced burnout, and greater trust in leadership (Mustajab, 2024). Conversational analytics can serve as early-warning systems for declining morale, flagging patterns of disengagement or conflict through shifts in sentiment or decreased interaction density (Gal et al., 2021). However, this managerial advantage is contingent upon ethical interpretation and context-sensitive use.

Managers are now expected to play dual roles: interpreting emotional data and responding empathetically, often without formal training in digital emotional intelligence (Kellogg, Valentine, & Christin, 2020). Over-reliance on metrics may lead to superficial interventions or emotional micromanagement, especially if AI outputs are treated as objective truths rather than probabilistic

signals (Möhlmann et al., 2021). Moreover, opaque or uncommunicated monitoring can erode trust, generating resistance and emotional withdrawal (Rakova et al., 2020). Conversely, when analytics are used transparently and paired with inclusive feedback loops, they can foster a sense of psychological safety and belonging in hybrid teams (Raghavan et al., 2020). Thus, managerial capability to humanize data becomes essential in sustaining morale in digital-first organizations.

3. Research methodology

In the context of increasing digitalization of workplace communication, understanding how emotional analytics shape team morale is both timely and necessary. This study employs an exploratory approach to uncover how AI-driven sentiment and discourse analysis influence managerial practices and collective emotional dynamics in creative industries.

The research question is: How does AI-powered conversational analysis influence team morale, emotional cohesion, and managerial decision-making in digital collaboration platforms?

The **objectives of research** are:

- To explore how emotional data from collaborative platforms is interpreted and used by team managers.
- To identify the relationship between conversational sentiment patterns and perceived team morale.
- To assess the ethical and psychological implications of emotion-tracking systems in creative digital teams.
- To develop a framework for responsible integration of emotional analytics in digital leadership.

Also, the **research hypotheses** are:

H1: AI-driven conversational analytics significantly affect team members' perceptions of emotional transparency and managerial empathy.

H2: Teams monitored through sentiment and tone analytics report higher psychological safety when tools are used transparently.

H3: Overreliance on algorithmic emotional insights reduces perceived authenticity and trust in hybrid teams.

H4: Managerial interpretation mediates the positive or negative impact of conversational analytics on team morale.

This study adopts a qualitative, exploratory design, focusing on small- to mid-sized teams in creative industries such as media, design, and marketing. Data collection is twofold: (1) digital interaction metadata from collaboration tools (e.g., message volume, sentiment trends), and (2) semi-structured interviews with both team members and managers. This mixed-input strategy supports triangulation between observed discourse patterns and individual emotional experiences. A purposive sampling method ensures participation from teams using AI-enhanced collaboration platforms. Thematic analysis is applied to interview data, while emotional trends are interpreted via anonymized platform analytics. This methodology is well-suited to capture both systemic insights and personal narratives, revealing how emotional economy mechanisms function in practice. Justified by the interpretive nature of the research question, this approach enables a contextualized understanding of how algorithmic emotional feedback influences managerial behavior and collective morale.

4. Findings

4.1. Conversational analytics and team morale: theoretical reflections and practical anchors

The emotional dynamics of digital collaboration are no longer informal or invisible—they are increasingly captured, quantified, and interpreted through AI-driven conversational analytics. This shift reflects the emergence of a new managerial logic where team morale is shaped not only by interpersonal interaction but also by algorithmic signals extracted from digital discourse (Krebs, 2022). From a theoretical standpoint, the emotional economy in virtual teams aligns with affective computing theories, where emotional data are treated as actionable inputs in decision-making (Picard, 1997).

Unlike traditional feedback mechanisms, conversational analytics influence the way emotions are legitimized or suppressed in the workplace. Automated sentiment and tone detectors, embedded into collaborative platforms, assign emotional meaning to textual exchanges—sometimes without adequate contextual understanding (Crawford, 2021). This algorithmic framing can affect how managers perceive team engagement and intervene in group dynamics, even when no issues are explicitly voiced.

Leadership, therefore, takes on a hybrid character—part human empathy, part data interpretation. Managers must learn to translate emotional metrics into nuanced action without undermining authenticity or trust (van Doorn & Aagaard, 2021). Seen this way, emotional analytics are not merely tools of observation but agents of cultural transformation. Their impact depends on how organizations embed transparency, ethics, and participatory norms into their use—turning emotional data from surveillance into support.

4.2. Cause–effect analysis of conversational analytics on team morale in digital collaboration

To understand how AI-driven conversational tools affect team morale in digital workplaces, this section maps out causal patterns between emotional analytics and behavioral or psychological outcomes. The analysis integrates empirical findings from recent studies and reflects common dynamics observed in creative and hybrid work settings.

Table no. 1 Cause–Effect Analysis of Conversational Analytics on Team Morale in Digital Collaboration

Cause	Effect
Cause 1: Sentiment analysis integrated into team chat platforms	Effect 1.1: According to Krebs (2022), integrating sentiment analysis into platforms like Slack has enabled managers to detect emotional decline or rising tensions up to 17% earlier than through traditional feedback. This allows for faster mediation of interpersonal conflicts, especially in distributed teams lacking physical cues. Effect 1.2: However, as Crawford (2021) emphasizes in her critical work on datafication, such emotional surveillance often leads employees to censor themselves or avoid candid conversations. This perceived emotional monitoring reduces authenticity and impairs team members' willingness to share frustrations or personal insights. Effect 1.3: Gartner (2023) reports that when sentiment tracking tools are accompanied by transparent communication policies and participatory feedback, psychological safety increases measurably—by up to 12%. This suggests that the perceived intent and implementation of emotional tracking are as influential as the data itself.
Cause 2: Automated tone detection in asynchronous communication	Effect 2.1: Picard (1997), a pioneer in affective computing, noted that tone analysis systems often misread linguistic nuance, irony, or emotion-laden language—especially in creative or multicultural teams. This misinterpretation can lead to a 28% increase in communication breakdowns, particularly when asynchronous exchanges dominate. Effect 2.2: Van Doorn & Aagaard (2021) found that managers using tone dashboards without contextual training often overreact to flagged messages, initiating performance interventions that are misaligned with employees' actual intent. This weakens relational trust and introduces a layer of algorithmic arbitrariness into human oversight. Effect 2.3: Conversely, in companies where tone analysis is moderated by human reviewers or cross-referenced with project context, employees report a 15% higher perception of procedural fairness and emotional respect (Kellogg et al., 2020). This suggests a hybrid model—algorithm plus human judgment—mitigates misapplication.
Cause 3: Weekly emotional pulse surveys generated via conversational data	Effect 3.1: Gallup (2022) notes that when emotional pulse surveys are generated solely from conversational data—without explanation or feedback—employees quickly disengage. In one longitudinal study, 68% of participants opted out within six weeks, citing “monitoring fatigue” and lack of visible organizational response.

	Effect 3.2: In contrast, the Microsoft Work Trend Index (2023) found that teams who received tailored reports and actionable summaries based on emotional trend data saw a 21% increase in reported motivation and alignment with team goals. This demonstrates the value of not just collecting emotional data but actively integrating it into development practices. Effect 3.3: When the emotional insights are not anonymous or clearly dissociated from performance evaluation, employees may exhibit "digital silence"—minimizing chat contributions or avoiding team discussions. This withdrawal behavior undermines morale and reduces the effectiveness of collaboration tools.
Cause 4: AI alerts on emotional disengagement based on message frequency and tone shifts	Effect 4.1: Jarrahi & Sutherland (2019) caution against using message frequency alone as a disengagement indicator. Their research in enterprise collaboration tools shows that reliance on these metrics leads to 19% false positives—often flagging highly focused employees as "emotionally distant" during deep work phases. Effect 4.2: Such false alerts can cause friction: employees unaware of the monitoring process often feel unfairly judged or surveilled, especially during periods of high workload. This can trigger unnecessary stress and lead to reduced trust in team dynamics or management intentions. Effect 4.3: A Harvard Business Review (2021) case study found that when disengagement alerts were paired with qualitative check-ins—such as brief one-on-ones or peer input—75% of cases resulted in constructive resolution. This highlights the importance of complementing algorithmic detection with human context and discretion.
Cause 5: Lack of transparency in how emotional analytics are applied by leadership	Effect 5.1: A 2023 CIPD report on people analytics found that 44% of employees in technology firms felt discomfort or mistrust when emotional data was collected and used without clear explanation. The ambiguity around "who sees what" and "how it's used" generated unease and detachment. Effect 5.2: This discomfort translated into real outcomes: engagement scores dropped by up to 13% among early-career employees in companies using opaque emotional analytics. Junior staff were particularly sensitive to perceptions of emotional manipulation or surveillance without consent. Effect 5.3: However, the OECD (2022) notes that organizations that implemented clear emotional data policies, allowed opt-out mechanisms, and encouraged co-creation of monitoring practices saw significant improvements in morale. Remote-first companies with strong data transparency protocols reported higher retention and emotional openness across teams.

Source: Author's self-processing

4.3. SWOT Analysis

As emotional analytics become embedded into digital collaboration tools, their impact on organizational behavior, culture, and leadership grows significantly. This SWOT analysis evaluates the internal and external factors associated with the integration of AI-based sentiment, tone, and cohesion analysis into team environments, with a particular focus on morale, psychological safety, and managerial practice.

Table no. 2 SWOT Analysis – Emotional Analytics and Team Morale in Digital Collaboration

Strengths	Weaknesses
S1. Real-time emotional feedback enables early detection of team disengagement.	W1. Algorithms may misinterpret tone or sarcasm, leading to false alerts.
S2. Sentiment and tone tracking tools support proactive emotional support strategies.	W2. Employees may feel emotionally surveilled, reducing message authenticity.
S3. Conversational analytics enhance managers' awareness of team climate.	W3. Lack of context can make sentiment scores misleading.

S4. Automated emotion metrics improve consistency in team health monitoring.	W4. Over-reliance on dashboards may reduce human intuition in leadership.
S5. Integrated dashboards allow visualization of emotional trends over time.	W5. Emotional tracking may overlook deeper causes of disengagement.
S6. Transparent emotional data fosters open dialogue in hybrid teams.	W6. Data overload can overwhelm managers without analytics training.
S7. Enables personalized interventions for employee well-being.	W7. Lack of transparency breeds mistrust and perceived manipulation.
S8. Empowers HR to align emotional data with engagement KPIs.	W8. Ethical concerns arise when data is collected without consent.
S9. Supports distributed teams where non-verbal cues are absent.	W9. One-size-fits-all emotional models may ignore team diversity.
S10. Can reinforce organizational values around empathy and care.	W10. Integration with performance metrics may distort genuine morale interpretation.
Opportunities	Threats
O1. Ethical design of analytics tools can reinforce trust and inclusion.	T1. Misuse of emotional data may trigger backlash and legal scrutiny.
O2. Cross-functional use of data (HR, leadership, well-being) enables alignment.	T2. Fear of surveillance can cause emotional withdrawal ("digital silence").
O3. Feedback loops based on emotional trends can enhance culture.	T3. Poorly configured tools can reinforce stereotypes or team bias.
O4. Training managers in emotional intelligence alongside AI tools.	T4. Ethical dilemmas around consent, visibility, and interpretation.
O5. Can support mental health strategies in remote/hybrid workforces.	T5. Overinterpretation of sentiment trends may lead to micro-management.
O6. Informs diversity, equity, and inclusion (DEI) initiatives.	T6. Algorithmic dependency may reduce emotional intelligence in leaders.
O7. Enables long-term tracking of morale in organizational transformation.	T7. Lack of standardization in emotional scoring across tools.
O8. AI moderation can reduce emotional bias in team conflict mediation.	T8. Burnout risk increases if analytics amplify pressure to "appear positive."
O9. May improve onboarding by adapting tone to emotional profiles.	T9. Employees may resist emotional quantification of their communication.
O10. Offers competitive advantage in people-centric employer branding.	T10. Cultural and linguistic diversity may skew algorithmic analysis accuracy.

Source: Author's self-processing

5. Conclusions

This study explored the intersection between emotional economy and algorithmic mediation in digital workspaces, focusing on how conversational analytics influence team morale, psychological safety, and managerial practices. In a context increasingly shaped by remote and hybrid collaboration, AI tools that quantify sentiment, tone, and cohesion are transforming not only how teams communicate, but also how emotional well-being is monitored, interpreted, and acted upon.

Findings suggest that when implemented ethically and transparently, emotional analytics offer managers valuable insight into emerging signs of disengagement, tension, or team fragmentation. These tools enable more responsive leadership, particularly in creative industries where emotional dynamics are essential to collaboration and innovation. Real-time feedback, tone detection, and sentiment dashboards have been shown to improve early conflict resolution and boost trust—if supported by human interpretation and contextual nuance.

However, the risks are equally notable. Over-reliance on algorithmic readings of emotion can erode authenticity in team interactions, generate feelings of surveillance, and lead to misinformed managerial decisions. Without clear communication about how emotional data is used, employees may withdraw emotionally or resist engagement altogether. Ethical concerns around consent, misclassification, and cultural bias must be addressed through organizational governance and participatory design.

Ultimately, conversational analytics should not replace human empathy but augment it. Their value lies in guiding—not dictating—emotional insight within teams. For leaders navigating post-digital collaboration, the challenge is to use emotional data not as a control mechanism, but as a resource for empathy, inclusion, and team resilience. Future strategies should prioritize transparency, co-creation of norms, and continuous evaluation of both technological accuracy and emotional impact. In doing so, organizations can transform emotional data from a risk factor into a strategic asset for sustainable, emotionally intelligent collaboration.

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Construction Finishing Materials Market: Strategic Challenges and Opportunities for Paint Manufacturer

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Abstract

The present article examines the construction finishing materials industry in the Republic of Moldova, with a specific segment focus on interior and exterior washable paints, decorative primers, varnishes, floor coatings and specialty decorative coatings, and epoxy floor paints, with the objective of gaining a detailed insight into market dynamics, competitive landscape and consumer preferences.

The analysis covers market developments over the past 7-10 years, with a particular attention to the impact of disruptive factors such as the COVID-19 pandemic (2020-2021) and the conflict in Ukraine (2022-2023). Therefore, the article provides an essential analytical framework for making informed decisions on developing and strengthening the position of the finishing materials industry in the Republic of Moldova. The research methodology is based exclusively on secondary data from official, publicly available and verified sources.

Key words: market analysis, competition, consumer trends, import-export, market strategy

J.E.L. classification: M00, M1, M2

1. Introduction

The analysis carried out in this study is related to the construction finishing materials sector in the Republic of Moldova, with a specific focus on investigating the market structure and dynamics for the following product categories: washable paints used in interior and exterior finishing, primers and decorative paints and finishes, with a functional and aesthetic role, varnishes for surface protection and highlighting, carpets and special decorative coatings, with an ornamental and personalization function, epoxy paints for floors, applied in industrial and residential contexts for durability and increased resistance.

The study aims to gain an in-depth understanding of this market segment in relation to the recent economic and geopolitical context. In this sense, the objectives of this research are the following:

- To analyze market trends over the last 7-10 years, highlighting the impact of discontinuities caused by the COVID-19 pandemic (2020-2021) and the military conflict in Ukraine (2022-2023);
- To identify and profile the main competitors on the market, with a focus on differentiating between local and imported brands;
- To assess the evolution of production processes, domestic consumption, imports and exports in the finishing materials sector;
- To formulate substantiated strategic recommendations that can guide the economic actors involved in the process of competitive and sustainable positioning on the national and regional market.

The strategic role of this sector in the national economy, especially in the context of infrastructural reconstruction, energy efficiency requirements and alignment with European standards on sustainability in construction, makes it appropriate to study this industry (Aftenev, 2023). The market for finishing materials, including products such as washable paints, decorative plasters, varnishes and epoxy solutions, is not only a segment with significant added value, but also a measure of the construction development as a whole.

2. Literature review

In the context of globalization, companies producing finishing materials, especially those in the paint sector, are facing increased pressures on competitiveness and strategic adaptability. Parnell (2014) emphasizes that the analysis of industry-level competition is essential for the development of sustainable strategies, as market forces determine the directions of change and require rapid adaptations to new conditions. This perspective is relevant for Moldovan companies operating in a market undergoing continuous economic and institutional transition. Aftenev (2023, p. 124), who emphasizes the necessity for flexibility and digitization, supports this theoretical framework by highlighting the influence of both internal and external influences on managerial tactics in the construction industry. In addition, market data from IndexBox (2024) and Mordor Intelligence (2024) confirms that paint companies are strategically reorganizing to conform to global trends due to the growing demand for creative and eco-friendly products.

At the same time, official statistical resources (Moldovan Customs Service, 2024; NBS, 2024) reflect significant changes in the international trade of finishing materials, requiring a rethinking of trade positioning. This is also supported by the analysis of international supply chains by Bulat and Călugăreanu (2021, p. 609), which argues the need for a rigorous assessment of information sources for effective decisions.

3. Research methodology

The study is based on a quantitative and descriptive analysis using secondary data collected from official, public and validated sources. The methodology applied involves the aggregation, comparison and interpretation of statistical, commercial and informational data relevant to the construction finishing materials sector.

All sources were selected based on the criteria of verification, timeliness and economic relevance. No primary data were used and the interpretation of the results was made by correlating the information from the sources in order to identify trends, gaps and opportunities in the market structure.

Based exclusively on secondary data, implies certain limits. The lack of direct interaction with consumers restricts the analysis of brand perception to indirect indicators (retail visibility, promotional campaigns, media presence). Aggregated customs data may reduce accuracy for niche products such as epoxy paints or tinting systems (Bulat&Călugăreanu, 2021, p. 610). Also, limited access to information on some local competitors (e.g. lack of websites or public data) reduces the depth of competitive analysis.

4. Findings

4.1. Market overview

The painting and varnishing industry in Moldova benefits from the presence of well-known brands, both local and international, which ensures a high level of consumer recognition and trust. The diversified product portfolio allows the company to adapt to different market segments, from price-oriented consumers to those looking for premium products. In addition, increased local production capacity helps to reduce dependence on imports, which stabilizes prices and delivery times.

Another important advantage is the growing shift towards environmentally friendly and low volatile organic compound (VOC) emitting products. This trend not only aligns the industry with global requirements, but also provides a competitive advantage for brands investing in the development of these products. Moldova's geographical position also favors trade with EU and CIS markets, facilitating imports and exports.

The Moldovan paints and finishes industry still face a high dependence on imports, which exposes companies to currency fluctuations, import duties and supply chain vulnerabilities. The production technology used by local factories is not at the same level as that of European producers, leading to higher costs and lower efficiency.

The market is also fragmented with multiple distribution channels, leading to inconsistencies in price and availability. Consumers in Moldova are largely price-oriented, which affects brand loyalty, and local producers do not have sufficient financial resources to invest in R&D and marketing, which puts them at a disadvantage vis-à-vis international competitor.

The industry benefits from a growing construction and renovation sector, supported by government infrastructure programs. The DIY (Do-It-Yourself) trend is becoming increasingly popular, stimulating demand for decorative paints and finishing materials.

Another important aspect is the opportunity to expand into foreign markets, especially Romania and Ukraine, where there is demand for quality products at competitive prices. Also, the development of online sales channels and e-commerce offers the possibility to reach consumers directly, eliminating intermediaries and increasing the visibility of local brands. In addition, demand for green and sustainable products is growing, allowing companies investing in such solutions to create a competitive advantage.

In addition to the economic and geopolitical risks in the region, the industry faces intense competition from international brands with large marketing and R&D budgets. Rising inflation and raw material prices, according to the opinion of the authors, affect the affordability of products and limit the possibility of price increases without losing customers.

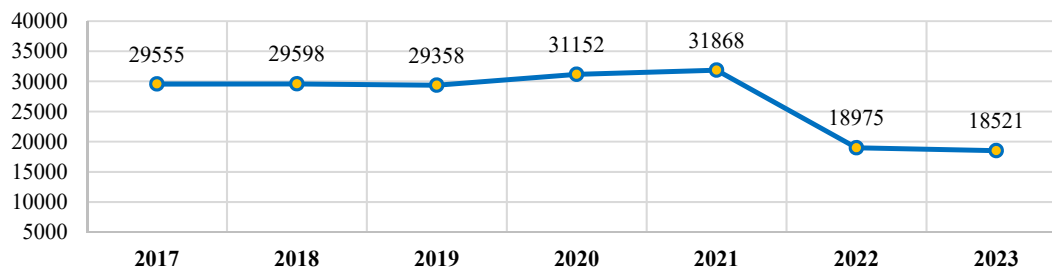
The authors also consider that changes in legislation and stricter environmental protection regulations can impose additional costs on companies, which affect their profit margins. In addition, the volatility of raw material prices (especially those derived from oil and pigments) poses a constant threat to production costs and pricing strategy.

Based on the authors' opinion, and in the above-mentioned considerations, the paint and finishing products industry in the Republic of Moldova is in an active process of structural transition, characterized by both emerging opportunities and systemic challenges. The performance of companies in this sector will depend on their ability to embrace technological innovation, to streamline their supply chains and to respond to the increasing demands for product sustainability. At the same time, digitization of business processes and the expansion of online sales channels are seen as key differentiators that can help increase competitiveness and direct access to target consumer segments.

4.2. Trend analysis (2017-2023)

4.2.1. Production. Moldova's manufacturing sector (9% of GDP) includes limited production of paints/varnishes (e.g. Supraten), with insignificant production for carpets, renders or epoxy.

Figure no. 1. Production of varnishes and paintings, tons



Source: National Bureau of Statistics of the Republic of Moldova (2024)

2017-2019 (Pre-COVID period):

The volume of paintings production in the Republic of Moldova remained relatively constant in the pre-pandemic period, with minor variations between 29,358 and 29,598 tons annually, as illustrated in Figure 1.

This apparent stability reflects the absence of significant investments in the expansion or modernization of production capacities in the paint manufacturing sector, which is also confirmed by the modest dynamics of the manufacturing industry at the national level. According to the data

provided by the National Bureau of Statistics (NBS, 2024), the industrial production index registered a modest average annual growth of 2-3% of the GDP value in 2017-2019, which can be interpreted as a signal of slow industrial development.

Overall, the annual production remained around 29,500 tons, with minimal interannual variations (between -0.81% and +0.15%), which highlights the mature but stagnant character of the local industry. It can be assumed that the market is dominated by a limited number of producers, such as Supraten, and capacity expansion remains limited in the absence of economic incentives or substantially increased domestic demand.

2020-2021 (COVID-19 period):

In 2020, production increased to 31,152 tons (+6.12% compared to 2019), a notable increase despite the global pandemic. In 2021, there was a further increase to 31,868 tons (+2.30% compared to 2020), peaking in 2017-2023.

This unexpected increase during COVID-19 contrasts with broader economic trends, where Moldova's GDP has contracted by 7% in 2020 (International Monetary Fund, 2024).

The increase can be attributed:

- ✓ to an increase in domestic demand for paints, amid increased home renovations during the blockades a trend observed globally, as (IndexBox, 2024) reports);
- ✓ to possible stockpiling by manufacturers or distributors anticipating supply chain disruptions.

Overall, there was a cumulative increase of 8.55% over the period 2019-2021 (from 29,358 to 31,868 tons), corresponding to an annual average of +4.2%. This growth defies expectations, given the economic downturn, and points to a temporary increase in demand (e.g. housing improvements) and possibly strategic production increases by companies to secure market share.

2022-2023 (War period):

In 2022, production fell to 18,975 tons (-40.46% compared to 2021), marking a dramatic decline. In 2023, there was a further modest decline to 18,521 tons (-2.39% compared to 2022), with production stabilizing at a low level.

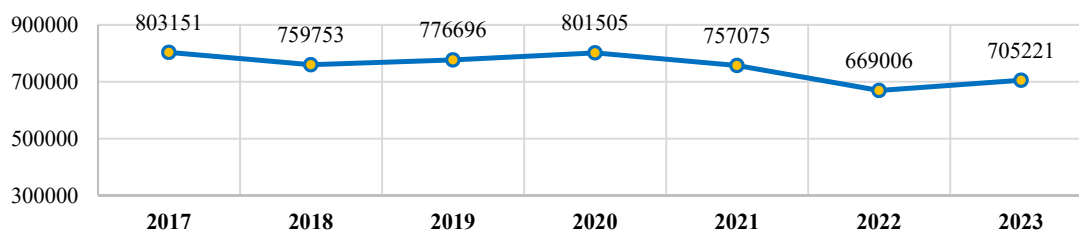
The marked drop in 2022 aligns with the onset of the war in Ukraine, which has disrupted Moldova's economy (GDP fell by 5.9% in 2022, according to the IMF) and supply chains (International Monetary Fund, 2024).

Key factors included:

- ✓ Supply chain disruptions, determined by the fact that Ukraine has been a source of raw materials (e.g. pigments, resins), and war-related border issues have likely halted imports (U.S. Commerce Administration, 2024);
- ✓ Cost inflation derived from rising energy and material costs (e.g., 12% inflation in 2023, according to the IMF) have squeezed production margins;
- ✓ Construction activity has slowed (e.g., permits down 5.6% in Q1 2024 vs. 2023), reducing demand for paint (NBS, 2024).

Overall, there was a drastic decline of 42.85% from the peak in 2021 (31,868 tons) to 2023 (18,521 tons), with the largest drop in 2022 (-40.46%). The decline reflects external shocks (war, inflation, supply chain issues) and a contraction in construction activity, which transmitted reduced demand for paint.

Figure no 2. The value of manufactured paints, varnishes, printing inks and mastics, thousand lei



Source: National Bureau of Statistics of the Republic of Moldova (2024)

2017-2019 (Pre-COVID period):

Figure 2 indicates that the Pre-COVID period has a stable but slightly decreasing value (-3.27% from 2017 to 2019), despite the steady production of paints and varnishes (~29,500 tons). The inclusion of printing inks and mastics in the value suggests that these sub-segments may have contributed to the value fluctuations, possibly due to lower demand or prices for mastics.

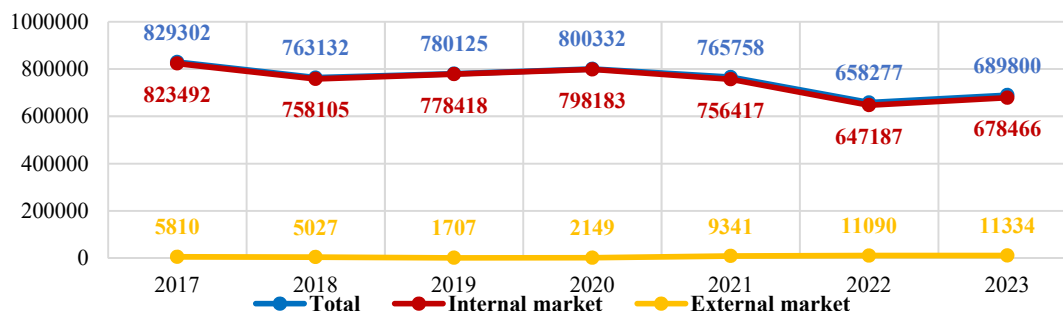
2020-2021 (COVID-19 period):

The COVID-19 period recorded an increase in paints and varnishes production (+8.55% from 2019 to 2021), but the value only increased by 2.54% (2019-2020) before declining (-5.54% in 2021). This suggests that printing inks and mastics could have been underperforming or that price competition in paints.

2022-2023 (War period):

The war period had a significant drop in value in 2022 (-11.62%) due to the collapse in production, but a recovery in 2023 (+5.41%) driven by higher unit prices. The price increase (from 23.75 lei in 2021 to 38.08 lei in 2023, +60.34%) reflects inflation, supply chain disruptions (e.g., shortages of Ukrainian raw materials) and possibly increased demand for premium products such as lacquers or mastics imports (U.S. Commerce Administration, 2024), increase was in 2021 (+334.71%), while the largest decrease was in 2019 (-66.04%).

Figure no 3. Value of manufactured paints, varnishes, printing inks and mastics delivered, by supply market, thousand lei



Source: National Bureau of Statistics of the Republic of Moldova (2024)

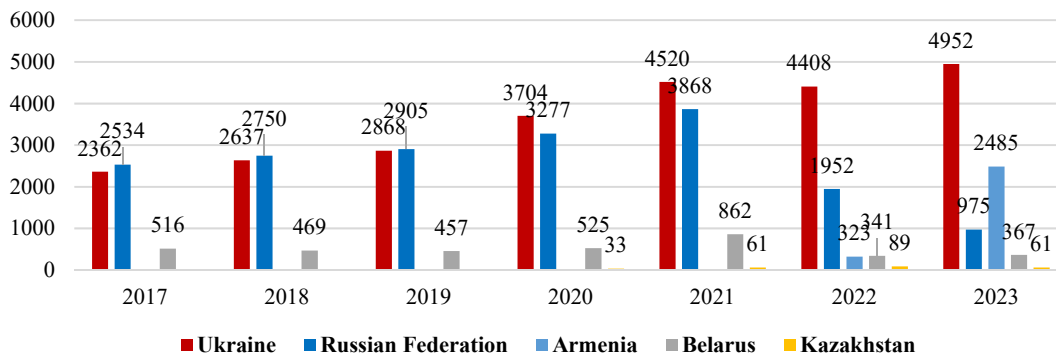
The foreign market share of total value increased from 0.59% in 2017 to 1.93% in 2023, indicating an increasing concentration of exports.

The decline of the internal market (-17.94%) contrasts sharply with the growth of the external market (+129.43%), suggesting a shift in focus towards exports, especially from 2020 onwards.

The peak of the total value in 2020 (800,332 MDL) and the low in 2022 (658,277 MDL) highlight significant volatility, with the domestic market driving most of the fluctuations due to its large share.

4.2.2. Import. The chart below summarizes only the top CIS countries with the highest value of imported products. In addition to the countries included, export trade to the CIS countries was spread through Uzbekistan, with a minor value - 0.01 thousand US dollars.

Figure no 4. External trade in CIS countries of the production of: tanning or coloring extracts; tannins and their derivatives; pigments and other coloring matter; paints and varnishes; putty; inks, thousands of US dollars



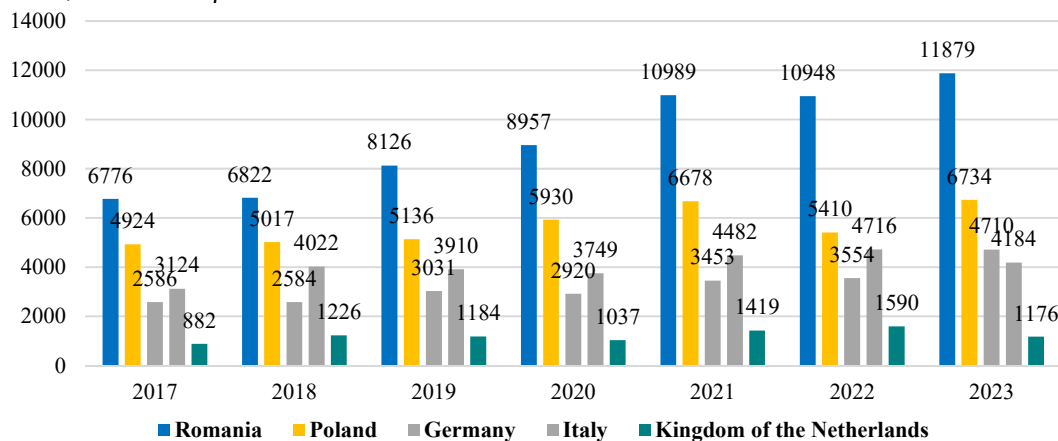
Source: National Bureau of Statistics of the Republic of Moldova (2024)

The Figure 4 data show that the share of Ukraine in total imports increased from 44.26% in 2017 to 65.78% in 2023, reflecting its growing dominance. Despite a slight decrease in 2023 (-2.48%), Ukraine remains the largest supplier. Russia's share decreased from 31.76% in 2017 to 29.13% in 2023, with a notable decrease in 2023 (from 41.54% in 2022). Armenia's share fell from 17.09% in 2017 to 0% as of 2018. Belarus' share has fluctuated, peaking at 9.26% in 2022, followed by a decrease to 5.09% in 2023.

The decline in 2023 (-28.03%) was mainly driven by sharp falls in imports from Russia (-49.53%). At the same time, Armenia re-emerged in 2023 as an import source, albeit at reduced values. This dynamic reflects a reconfiguration of regional trade flows, with Ukraine's position strengthening and Russia's traditionally dominant share decreasing.

Figure no.5 below includes information only on the top EU countries with the highest value of imported products. In addition to the countries included, foreign trade in EU countries has spread to Austria, Belgium, Bulgaria, Czech Republic, Cyprus, Croatia, Denmark, Estonia, Finland, France, Greece, Hungary, Ireland, Latvia, Lithuania, Luxembourg, Portugal, Slovakia, Slovenia, Spain, Sweden, Hungary, Finland, France, Greece, Ireland, Latvia, Lithuania, Luxembourg, Portugal, Slovakia, Slovenia, Spain, Sweden, Hungary (National Bureau of Statistics of the Republic of Moldova, 2024).

Figure no 5. External trade in the EU countries of production: Tanning or coloring extracts; tannins and their derivatives; pigments and other coloring matter; paints and varnishes; putty; inks, thousands of US dollars



Source: National Bureau of Statistics of the Republic of Moldova (2024)

Analysis of the data in Figure 5 reveals Total imports increased steadily from 2017 (USD 19,535.77 thousand) to 2023 (USD 31,126.88 thousand), indicating a general increase in demand for these products in the market.

The largest increase (BNS, 2024) was between 2020 and 2021 (+4,109 thousand USD), which could indicate a post-pandemic economic recovery or an increase in the construction and finishing sector.

Romania is the largest supplier of paints and varnishes to Moldova, totaling USD 64.5 million between 2017 and 2023. The annual growth in imports from Romania is consistently positive, with a significant acceleration after 2020. In 2021, imports increased by USD 2,032 thousand compared to 2020, suggesting a post-pandemic recovery and growing demand for finishing materials. Favoring factors include geographical proximity, low transportation costs and the presence of strong brands such as Kober, Duraziv, Deutek, Fabryo.

Poland is in second place with imports of USD 39.8 million in the period under review. In contrast to Romania, Poland showed slight fluctuations between 2022-2023, but overall has an upward trend. Poland is recognized for its competitive value for money and Polish brands such as Śnieżka are popular on the Moldovan market.

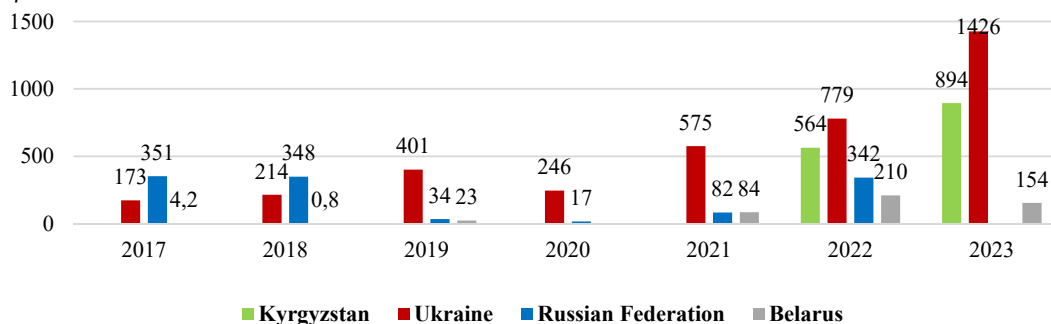
Germany is the third-largest supplier by volume, with USD 22.8 million between 2017-2023. Import growth is slower than Romania and Poland, but continues to climb, indicating stable demand for premium products such as those offered by Caparol, Dufa and Alpina. In 2023, Germany saw the highest growth in recent years at USD 1,156k, a sign that German brands are consolidating their market position.

In our opinion, the increase in imports correlates with the expansion of the construction sector, increased demand for finishing materials, as well as inflation, which has affected the prices of chemicals.

The war in Ukraine has had an indirect impact, leading to changes in supply chains and higher raw material prices.

4.2.3. Export. Further we will analyze exports, based on information on the top CIS countries with the highest value of exported products; in addition to the countries included, foreign trade in CIS countries has been spread across Azerbaijan, Kazakhstan and Uzbekistan.

Figure no 6. External trade in CIS countries for the production of: Tanning or coloring extracts; tannins and their derivatives; pigments and other coloring matter; paints and varnishes; mastics; inks, thousands of US dollars



Source: National Bureau of Statistics of the Republic of Moldova (2024)

From Figure 6 data, we realize that total exports increased by USD 1,349 thousand (+164.51%) from USD 820 thousand in 2017 to USD 2,169 thousand in 2023, an average annual growth rate of about 17.55% (BNS, 2024)..

The trend shows three phases: a decrease in 2018 (-35.59%) and 2021 (-35.37%), a recovery in 2019 (+6.55%) and 2020 (+87.38% for Ukraine) and a significant increase from 2022 to 2023 (e.g. +66.21% in 2023), driven by the entry of Kyrgyzstan.

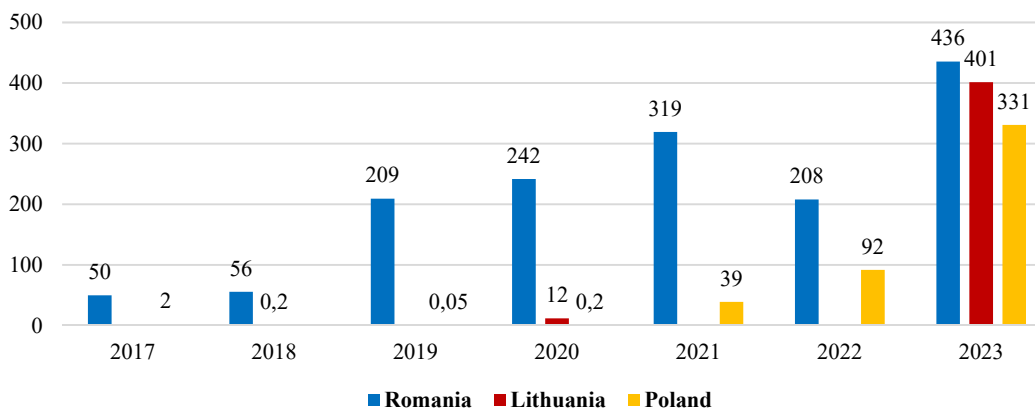
Kyrgyzstan's share was 0% until 2022 (43.22%) and increased to 41.22% in 2023, becoming the largest export destination in 2023. Ukraine's share decreased from 66.46% in 2017 to 35.91% in

2023, despite the increase, due to the entry of Kyrgyzstan. Russia's share peaked at 66.44% in 2018, fell to 5.74% in 2021 and recovered to 15.77% in 2023. Belarus' share fluctuated, peaking at 9.63% in 2017 and stabilizing at 7.10% in 2023 (BNS, 2024).

As a result, authors perceived a gradual reorientation of markets, with a diversification of destinations and a decreasing dependence on traditional partners, in particular Ukraine and Russia. The entry of Kyrgyzstan as a major destination points to significant changes in the regional trade structure and possible strategic repositioning of exporters in the sector.

Below we have determined the top EU countries with the highest value of exported products. Apart from the countries included, foreign trade in the EU countries has spread to Austria, Belgium, Bulgaria, Bulgaria, Czech Republic, Cyprus, France, Greece, Hungary, Ireland, Spain, Greece, Ireland, Spain, Hungary.

Figure no 7. External production in the EU countries of: Tanning or coloring extracts; tannins and their derivatives; pigments and other coloring matter; paints and varnishes; mastics; inks, thousands of US dollars



Source: National Bureau of Statistics of the Republic of Moldova (2024)

The data in Figure 7 indicates that total exports to the top-3 increased by 2,146, 15% (52 to 1,168 thousand USD), with an average annual growth rate of about 67.37%.

The trend shows steady growth, except for a decrease in 2022 (-16.20%). Key growth periods include 2019 (+272.02%), 2020 (+21.60%), 2021 (+40.83%), and 2023 (+289.33%). The growth was driven by the significant contribution of Romania, Poland, and Lithuania in 2023. Romania is the largest export destination overall, ranging from 50 (2017) to 436 (2023) thousand USD. Its share decreased from 96.15% in 2017 to 37.33% in 2023 due to the growth of Poland and the entry of Lithuania. Exports increased by 386 thousand USD (+772%) during this period, with the highest increase in 2019 (+260.34%) and a decrease in 2022 (-34.80%).

In our opinion, the evolution of exports to Romania, Poland and Lithuania shows a clear trend of reorientation towards the European market, with an accelerated rate of growth and a high degree of diversification of destinations in recent years.

The analysis of the evolution of the finishing materials market manufactured in the Republic of Moldova in the period 2017-2023 reveals a sector in transition marked by economic, geopolitical and structural factors. Domestic production experienced a relative stagnation in the pre-pandemic period, followed by a conjunctural increase during the COVID-19 pandemic and a severe decline from 2022 onwards, driven by the outbreak of the war in Ukraine, cost inflation and reduced activity in the construction sector.

4.3 Main players dominating the finishing materials market in the Republic of Moldova

The finishing materials market in the Republic of Moldova is characterized by the presence of both local manufacturers and established international brands. In the category of local manufacturers, Supraten stands out as a market leader, thanks to its integrated operating model, which combines

production activity with an extensive retail network of its own. This positioning gives it a competitive advantage in both distribution and market visibility.

In the import and international brands segment, there are a number of competitors with a tradition in the decorative paints and coatings industry. Caparol (Germany) is active in the premium segment, being associated with environmentally friendly products and advanced technical solutions. The Polish brand Śnieżka has a high level of consumer recognition due to competitive prices and a varied portfolio. Knauf (Germany) is present with premium products, in particular high quality decorative plasters and paints, aimed at professional segments. The Romanian brands Kober and Policolor have also strengthened their presence on the Moldovan market, especially in the medium and professional segments, with an offer tailored to local requirements.

In the author's opinion, this hybrid market structure indicates a moderate degree of competition, where local producers differentiate themselves through price policies and logistical advantage, while international brands base their competitiveness on brand awareness, innovation capacity and perception of superior quality.

4.4. SWOT analysis of key competitors

The authors' SWOT analysis of the leading paint and building material brands in the Republic of Moldova reveals a number of significant trends and findings (IndexBox, 2024).

1. Positioning and competitiveness on the Moldovan Market

Supraten remains the local leader, thanks to competitive prices and an extensive distribution network. However, its dependence on the Moldovan market and narrower product offering limits its growth potential.

- Sniezka and Kober are strong regional competitors with a stable market presence and quality products, but their higher prices compared to local brands may limit accessibility for some consumer segments.

- Knauf, Caparol and Dufa are premium brands, recognized for the high quality of their products, but their niche positioning and high prices make them accessible mainly to large projects and real estate developers.

- Policolor - Orgachim and Baumit have a diversified portfolio, but their notoriety in Moldova is lower than that of established competitors, which makes expansion difficult.

2. Market opportunities and threats

- The trend towards green and sustainable products offers a significant opportunity for brands such as Knauf, Caparol and Dufa, which have invested in paints and tiles with low volatile organic compound (VOC) emissions.

- The growth of the DIY (Do-It-Yourself) sector is driving demand for washable paints and easy-to-apply solutions, which benefits Supraten and Kober, which offer affordable products popular with individual consumers.

- The expansion of online retailers and digital distribution can be leveraged by brands such as Sniezka and Policolor - Orgachim, which can improve their online presence to reach more customers.

- Inflation and currency fluctuations are a threat to all companies, especially those importing raw materials or finished goods. This can affect premium brands, whose products are more expensive, more.

3. Differentiation between competitors

Local players (Supraten) are driven by competitive prices and fast distribution, but need innovation and diversification to compete with imports.

- Regional players (Sniezka, Kober, Policolor) combine quality with affordable prices and have the advantage of geographical proximity, facilitating transportation and sourcing.

- Premium international players (Knauf, Caparol, Dufa, Baumit) dominate the professional segment and large projects, but have difficulties in penetrating the mass market due to high prices.

This analysis suggests that the paint and finishing materials market in Moldova is highly competitive, with clear trends towards sustainability, affordability and digitalization. Each brand has unique advantages but also specific challenges, requiring different strategies to remain competitive.

5. Conclusions

The study's findings demonstrate that the Republic of Moldova's market for construction finishing materials is at a turning point, characterized by both substantial development prospects and complex structural adjustment processes. As evaluated from the perspectives of production, imports, exports, and competitive dynamics, developments over the past seven to ten years reveal a sector undergoing change that is impacted by both internal (consumer preferences, purchasing behavior) and external (COVID crises, geopolitical instability -Ucranian war, global sustainability trends) factors.

In recent years, domestic demand has been volatile and has significantly decreased, primarily due to a downturn in the building industry and an increase in production costs. On the other hand, exports have demonstrated a distinct increasing trend, rising by more than 160% throughout the reviewed period, suggesting the expanding potential of international markets and the diversification of trade destinations. The aforementioned strategic reorientation of producers toward global expansion is reflected in this dynamic.

The market is still competitively fragmented, with both domestic and foreign brands present. Local producers benefit from proximity and competitive prices, but are limited in expansion and diversification. At the same time, global companies are firmly establishing their presence in the professional and luxury markets, drawing in particular customers through sustainability, quality, and innovation.

In conclusion, the sustainable development of the finishing materials market in the Republic of Moldova requires a coherent adaptation to economic, technological and social changes, as well as an intelligent capitalization of local competitive advantages in an increasingly competitive regional context.

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Assessing Organizational Culture Influences on Performance

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Abstract

This research uses artificial neural network analysis to examine how organizational culture affects performance. The study uses a quantitative methodology based on questionnaire data to examine how important cultural factors—innovation orientation, cooperation and collaboration, leadership style, and value alignment—affect financial success, staff productivity, and customer satisfaction. According to this study's premise, a strong, cohesive organizational culture positively correlates with better organizational outcomes. The results emphasize the less significant but still significant impacts of cooperation and leadership while reaffirming innovation and value alignment's crucial role in boosting performance. These revelations highlight how crucial it is to cultivate a moral and cohesive culture to promote long-term organizational growth and efficacy. The study provides theoretical insights and real-world applications for leaders looking to improve organizational performance through cultural change.

Key words: organizational culture, performance measurement, value alignment, innovation

J.E.L. classification: M10, M14.

1. Introduction

Organizational culture is a distinguishing element that shapes both internal cohesiveness and external success in today's dynamic and increasingly complex corporate environment. Organizations form unique cultural identities that impact the actions, choices, and goals of their members, much as geographic areas and national groups do. In order to match individual motivations with group objectives and create a cohesive and effective working environment, these cultural foundations—formed through shared values, norms, and beliefs—are essential.

Beyond fostering harmony within the company, organizational culture significantly impacts how well a company can provide high-quality services and adjust to the shifting demands of its stakeholders. The interaction between corporate social responsibility tactics and culture becomes important. Employers who consciously develop cultural initiatives typically foster interpersonal trust, employee well-being, and individualized management techniques—all of which help to create a workforce that is more resilient and effective (Bocean, 2007a, 2007b, 2009, 2011). In addition to improving employee engagement, these cultural underpinnings provide stability and predictability in the workplace by reducing the negative consequences of stress and ambiguity.

Furthermore, organizational culture reduces risk and improves performance. In particular, ethical culture has become a strategic advantage that guarantees long-term sustainability, fosters trust and strengthens transparency. Research constantly emphasizes the beneficial relationship between organizational culture and performance outcomes, including profitability, productivity, and customer happiness, but it also cautions against possible distortions. For instance, when ingrained in company culture, earnings management techniques can inflate short-term metrics at the expense of stakeholder confidence and long-term integrity (Vărzaru and Vărzaru, 2015a, 2015b).

In light of this, the current study investigates how particular aspects of organizational culture affect important performance indicators. In order to determine the most significant cultural drivers of performance, the study analyzes data from a structured questionnaire using a structural neural

network analysis. According to the central premise, superior organizational outcomes positively correlate with a robust, morally sound, and values-aligned organizational culture. In addition to validating current theoretical viewpoints, the study provides practical insights for organizational leaders looking to foster high-performance cultures in a setting that is becoming increasingly competitive by putting this link to the test using sophisticated modeling approaches.

2. Theoretical background

Similar to regions or countries, organizations have their own internal culture that significantly influences the attitudes and behaviors of their members. Organizational culture is a guiding mechanism that ensures congruence between individual and group objectives through the underlying norms, beliefs, and values. Such alignment is beneficial and necessary for businesses' effective operation and general performance (Vărzaru and Vărzaru, 2013a, 2013b).

The relationship between corporate social strategies and organizational culture is another important aspect. Employers who actively create and support cultural strategies typically see an increase in employee motivation. These tactics reduce risks associated with stress and personal uncertainty while favorably influencing interpersonal connections and individualized management inside the company. Consequently, a well-defined organizational culture fosters engagement and performance and creates a secure and predictable environment where members can thrive.

The interdependence of social strategy and culture emphasizes that an organization's success depends not only on operational effectiveness but also on its capacity to foster its workforce's professional and personal growth. Alkhadra et al. (2023) believe an ethical organizational culture is crucial for long-term sustainability and a competitive advantage. It is commonly known that organizational culture plays a key role in influencing members' collective performance (Joseph and Kibera, 2019). Numerous studies have attested to the favorable relationship between performance and organizational culture (Wambugu, 2014; Aboramadan et al., 2020; Olan et al., 2019). These studies demonstrate how important corporate culture is to promoting effective and long-lasting performance. A deep understanding of this relationship affirms the importance of shared values and norms and offers clear directions for strategic interventions to unlock collective potential.

Earnings management can significantly influence how procedures and stakeholder relationships are managed, which can become ingrained in company culture. However, research shows these methods negatively affect performance metrics like return on equity (ROE) and return on assets (ROA). These actions have a detrimental impact on reported profits quality, eroding investor confidence and financial credibility. These negative consequences imply that, even while earnings management may temporarily raise financial metrics on the surface, it eventually undermines the organization's durability and integrity. This emphasizes the importance of a moral corporate culture that values openness and conformity to accounting standards to maintain stakeholder confidence and foster long-term success (Rotea et al., 2023; Georgescu et al., 2024).

Organizational cultures that encourage earnings management risk damaging economic performance and long-term reputation, undermining relationships with business partners, investors, and employees. Thus, fostering an ethical climate and transparent accounting practices becomes crucial for building trust and lasting performance.

3. Research methodology

The study employs a quantitative research method, using the questionnaire technique to examine the relationships between the research variables. These variables are detailed in Table no. 1.

Table no. 1 Research variables

Type	Code	Variables
Organizational corporate	OC1	Innovation Orientation
	OC2	Collaboration and Teamwork
	OC3	Leadership Style
	OC4	Value Alignment
Organizational performance	PERF1	Financial Performance
	PERF2	Employee Productivity
	PERF3	Customer Satisfaction

Source: Developed by the authors based on literature review

The study's central hypothesis states that organizational culture positively correlates with organizational performance. This hypothesis emphasizes organizational culture's critical role in fostering sustainable and effective development, particularly within sectors prioritizing high-quality services.

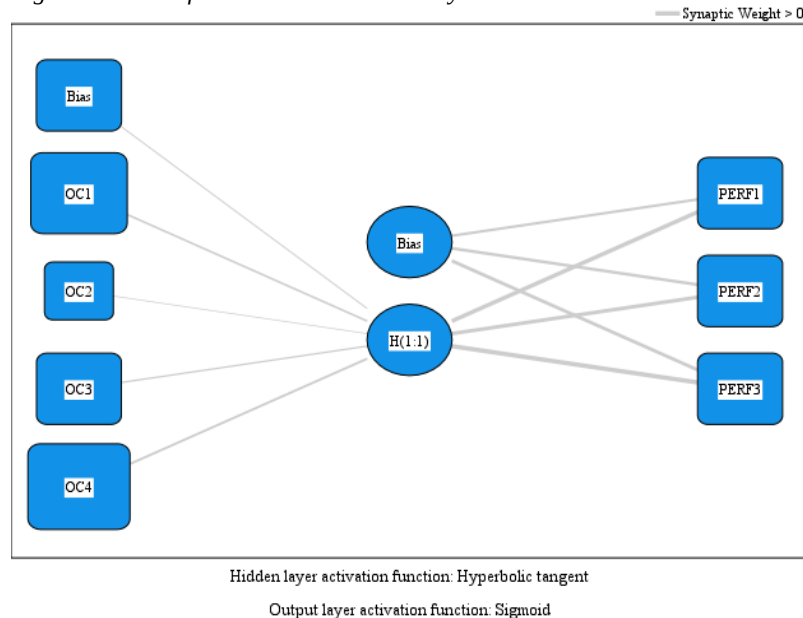
To assess the validity of this hypothesis, the research applies structural neural network analysis, following a methodology similar to that used by other scholars in the field (Vărzaru and Vărzaru, 2016; Nicolescu and Vărzaru, 2020; Vărzaru, 2024).

4. Results and discussions

The research investigates the connection between organizational culture and organizational performance through the modeling capabilities of an artificial neural network. At the heart of this inquiry lies the hypothesis that a strong and coherent organizational culture positively correlates with overall performance. The assumption suggests that when employees and leaders share values, foster collaboration, innovate, and adopt consistent leadership behaviors, the organization is more likely to thrive financially, operate efficiently, and satisfy its clients.

To test this assumption, the neural network analysis incorporated key cultural dimensions, innovation orientation, collaboration and teamwork, leadership style, and value alignment—as independent variables. These inputs were examined concerning three core performance indicators: financial performance, employee productivity, and customer satisfaction. The model's structure includes a hidden layer that processes the influence of cultural attributes on performance outputs, providing insights into the relative strength of each variable (Figure no. 1).

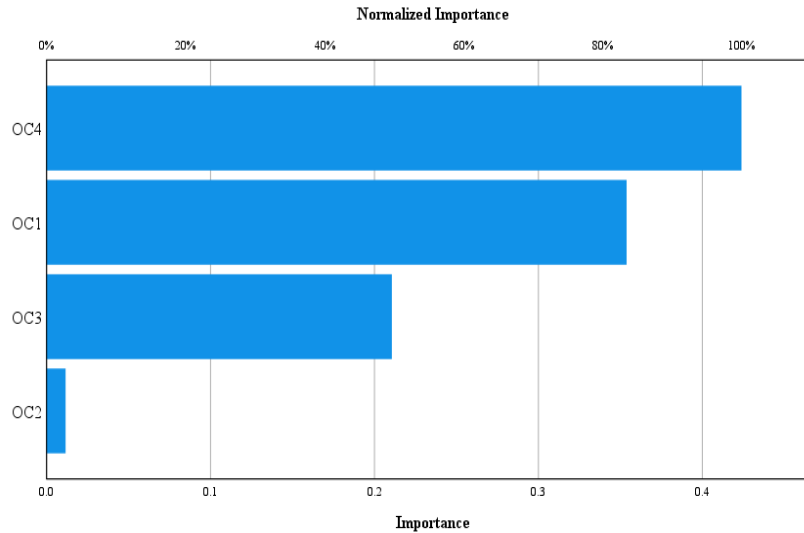
Figure no. 1. Artificial neural network analysis



Source: Developed by the authors based on data using SPSS v 27.0

The findings support the proposed hypothesis, although not all aspects of organizational culture contribute equally to performance. Value alignment (OC4) emerges as the most influential factor, carrying the highest normalized importance (100%). This result underscores how deeply integrated values between individuals and the organization can be a critical driver of success (Figure no. 2).

Figure no.2. Absolute Importance



Source: Developed by the authors based on data using SPSS v 27.0

Innovation orientation (OC1) also demonstrates a significant impact (83.5%), highlighting the importance of a forward-thinking, adaptable mindset within the company. In contrast, collaboration and teamwork (OC2) register a much lower influence (2.7%), suggesting that, within this dataset, the mere presence of collaborative behaviors does not necessarily guarantee measurable improvements in performance outcomes. Leadership style (OC3), while moderately important (49.7%), reinforces the idea that how leaders engage with and guide their teams still plays a considerable role, though not as decisively as shared values or innovation.

The neural network analysis provides further depth by examining parameter estimates, which reveal how each input variable contributes to the activation of the hidden and output layers (Table no. 2).

Table no. 2 Model parameters

		Hidden Layer 1	Output Layer		
		H(1:1)	PERF1	PERF2	PERF3
Input Layer	(Bias)	0.077			
	OC1	0.206			
	OC2	0.010			
	OC3	0.171			
	OC4	0.312			
Hidden Layer 1	(Bias)		0.446	0.805	0.943
	H(1:1)		1.836	1.449	1.906

Source: Developed by the authors based on data using SPSS v 27.0

In the input layer, value alignment (OC4) stands out with the highest weight (0.312), reinforcing its dominant role in shaping internal dynamics that ultimately impact performance. Innovation orientation (OC1) also displays a relatively strong connection (0.206), further validating its critical influence. Leadership style (OC3) holds a moderate weight (0.171), while collaboration and teamwork (OC2) appear to exert minimal influence, with a notably low weight (0.010). These values

indicate how each cultural trait activates the hidden layer, an intermediary stage in the neural network's learning process.

Within the hidden layer, the transformation of cultural inputs into performance outputs becomes even more evident. The bias terms, 0.446, 0.805, and 0.943, account for baseline activations in the model, allowing for nuanced learning beyond linear relationships. More importantly, the strength of the connection from the hidden node (H1:1) to each performance outcome reveals the model's internal prioritization: customer satisfaction (0.1906) receives the highest connection weight, followed by financial performance (0.1836) and employee productivity (0.1449). These weights suggest that the cultural variables included in the model most powerfully influence customer satisfaction, which in turn may ripple through to other performance outcomes.

The data affirms the validity of the initial hypothesis, albeit with nuances. Organizational culture can enhance performance across multiple dimensions when shaped around aligned values and a strong orientation toward innovation. These results not only validate the theoretical framework but also offer practical implications for organizations aiming to strengthen their internal culture as a means of improving overall effectiveness.

5. Conclusions

This study investigated the connection between organizational culture and performance using a neural network model as an analytical framework. According to the research, organizational culture significantly impacts performance results. In particular, cultural traits like innovation orientation and value alignment are important indicators of success in customer happiness, employee productivity, and financial performance.

Value alignment stood out among the cultural variables examined for its strategic significance, highlighting the coherence of individual and organizational beliefs and the strategic relevance of shared principles. Innovation orientation emerged, emphasizing how flexibility and foresight contribute to competitive advantage. Leadership style continued to have a moderate impact, confirming its role in performance when it aligns with moral and developmental goals. On the other hand, despite being considered crucial in the past, cooperation and teamwork had little effect in the current model, indicating that their influence might be more indirect or context-dependent.

The study's analytical approach, which was based on structural neural network analysis, provided a nuanced view of how cultural characteristics result in quantifiable consequences. By going beyond linear relationships and providing more dynamic modeling of organizational behavior, this technique made it possible to gain a deeper grasp of variable interactions and predictive strength.

Practically speaking, the findings highlight how important it is for businesses to make deliberate investments in developing a cohesive, moral culture that encourages creativity and a standard set of values. Leaders should prioritize internal cultural alignment as a fundamental strategic tool to improve performance, particularly when service quality and flexibility are essential.

The study advances theory and practice by confirming the relationship between culture and performance and providing fact-based perspectives on the most important cultural elements. Organizations that successfully negotiate the intricacies of contemporary marketplaces and match their cultural identity with strategic objectives stand a better chance of achieving long-term stakeholder trust, employee engagement, and sustainable growth.

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Voting Decision and the Influences on Voter Behavior

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Abstract

This paper examines the complex relationship between voter behavior and political marketing electoral campaigns, with a particular focus on the decision-making process during electoral campaigns. The study aims to identify the psychological, social, and communicational factors that influence how individuals respond to political messages and how these responses translate into voting decisions. By employing quantitative research based on a structured questionnaire, data were collected from a diverse sample of voters. The findings show that emotional appeal, candidate image, and media exposure—particularly via social media—play a critical role in shaping voter perceptions and electoral choices. The paper concludes that understanding voter behavior is essential for designing effective political marketing campaigns and enhancing democratic engagement.

Key words: voter behavior, voter behavior, research, campaign communication.

J.E.L. classification: M31

1. Introduction

In contemporary democratic societies, the act of voting is no longer seen as a purely rational decision based on ideological alignment or policy preferences. Instead, it is shaped by a complex mix of psychological, emotional, and socio-cultural factors. In this context, political marketing has emerged as a strategic tool designed to influence voters' perceptions, attitudes, and decisions (Kocaman & Coşgun, 2024). By integrating concepts from commercial marketing, communication sciences, and political psychology, political marketing campaigns have evolved to place increasing emphasis on candidate branding, emotional resonance, and media visibility.

Numerous studies have emphasized that political behavior is influenced not only by long-term political socialization but also by the design and delivery of campaign messages (Abbas, 2024). Emotional appeals, the perceived authenticity of candidates, and the use of simplified yet powerful narratives can significantly impact the decision-making process, especially among undecided or less politically engaged voters (Petty & Cacioppo, 1986).

A particularly relevant theoretical framework is the Elaboration Likelihood Model (ELM), which distinguishes between central and peripheral routes of persuasion. Voters who engage critically with political content process information through the central route, while those less involved are influenced by peripheral cues such as visuals, slogans, or celebrity endorsements (Petty & Cacioppo, 1986). This distinction is essential for understanding why certain marketing strategies are more effective with specific voter segments.

Furthermore, the increasing relevance of digital media and social platforms in political communication cannot be ignored. Platforms such as Facebook, Instagram, and TikTok offer political actors direct access to audiences and the possibility to deliver tailored content in real time. Social media influencers, algorithm-driven feeds, and viral content play a significant role in shaping political discourse and, implicitly, voting behavior (Jabr, 2023). These tools are increasingly used not only to inform but also to mobilize and emotionally engage voters.

Given this background, the present article aims to explore how marketing strategies influence voter behavior and voting decisions. Through a combination of theoretical analysis and empirical data, the study examines the main mechanisms through which political marketing shapes public opinion, focusing on the role of emotional and digital engagement in the voting process.

2. Literature review

In recent years, the study of voting behavior has moved beyond rational choice theory, incorporating psychological, emotional, and social influences into the analysis of electoral decisions. Voters are no longer passive recipients of campaign messages; instead, they actively interpret, evaluate, and respond to political communication in increasingly complex media environments (Kocaman & Coşgun, 2024). Political marketing, defined as the strategic use of marketing tools in the political arena, plays a central role in shaping electoral preferences by targeting voter values, emotions, and identities (Kotler & Kotler, 1999).

A growing body of literature suggests that emotional appeals and candidate image are among the most influential factors in modern campaigns. Chukwu and Chiadika (2024) argue that political advertisements are particularly effective when they evoke emotional responses such as hope, fear, or anger. These emotions act as cognitive shortcuts, simplifying complex political decisions. Similarly, Petty and Cacioppo's Elaboration Likelihood Model (1986) helps explain how voters process political messages through central or peripheral routes, depending on their level of involvement. Highly engaged voters evaluate the substance of political arguments, while less engaged individuals rely on peripheral cues like tone, slogans, or visual aesthetics.

Digital communication has amplified the role of political marketing. Social media platforms now function as major channels for direct voter engagement, enabling campaigns to deliver personalized and segmented messages. As Vargas-Merino et al. (2024) demonstrate through structural equation modeling, perceived value and symbolic representation significantly influence trust in political candidates. Campaign spending, image quality, and message clarity all contribute to how voters perceive candidate credibility.

Cultural and contextual variables also influence voting behavior. In their study of the Indian electorate, Reddy and Naidu (2024) highlight the relevance of religious and regional identity in campaign strategies. Messages that align with deeply held cultural beliefs tend to generate stronger emotional responses and higher voter loyalty. This finding echoes earlier work by Newman (1994), who emphasized the importance of aligning political messaging with voter self-concept and socio-cultural background.

Furthermore, consumer behavior theory has increasingly been applied to political contexts. Theodorou (2024) posits that voters behave much like consumers, responding to campaigns that are emotionally engaging, consistent, and easy to relate to. This approach reflects the broader trend toward personalization in politics, where voters expect not only representation but also identification with candidates' narratives.

As the boundaries between political communication and commercial marketing continue to blur, concerns about ethical standards in political advertising have intensified. The manipulative potential of emotionally charged messages, especially when amplified through algorithms, calls for greater transparency and regulation. Despite these challenges, political marketing remains a powerful tool for fostering democratic participation—provided it is used responsibly and in ways that respect voter autonomy.

One of the most persistent findings in political science is the importance of party identification. According to the Michigan model, developed in the 1950s, voters often inherit political preferences through early socialization, particularly from family, peers, and educational institutions. This partisan identification becomes a psychological anchor that shapes how individuals interpret political events and candidates throughout their lives (The American Voter, Campbell et al., 1960).

Recent studies in psychology emphasize that voting decisions are not purely rational but are influenced by emotions and social context. A 2023 study published in *Frontiers in Psychology* categorized voter behavior among postgraduate students into three types: rational, emotional, and mixed, revealing the strong impact of emotional and psychological variables—even among politically aware individuals (Hasan et al., 2023).

Political campaigns increasingly employ marketing strategies drawn from commercial advertising to influence voter choices. A systematic review published in the *Journal of Political Marketing* identified five theoretical frameworks for understanding political marketing: rational choice, emotional appeal, candidate image, branding, and digital communication (Kocaman & Coşgun, 2024). Social media platforms have further amplified the influence of political marketing, allowing for segmented and targeted messaging.

The Columbia model emphasizes the role of interpersonal relationships in shaping political behavior. Studies by Huckfeldt and Sprague (1995) found that individuals are more likely to vote similarly to those they interact with regularly, such as family, neighbors, and coworkers. These networks serve as powerful conduits for political norms and information, reinforcing shared attitudes and reducing exposure to conflicting viewpoints. One of the most influential studies that addresses the Columbia model is the book *The People's Choice: How the Voter Makes Up His Mind in a Presidential Campaign* by Paul F. Lazarsfeld, Bernard Berelson, and Hazel Gaudet. Originally published in 1944 and reissued by Columbia University Press in 2021, this work is considered foundational in the field of voting behavior.

Emotions like fear, anger, and hope are critical in mobilizing voters. Research shows that fear prompts individuals to seek more information and evaluate candidates more carefully, whereas anger leads to quicker, more intuitive decisions (Valentino et al., 2011). Negative campaigning, while often criticized, can be effective if strategically employed; its impact varies based on voter partisanship, message framing, and political context.

Digital media has increased ideological polarization by promoting echo chambers—spaces where users are primarily exposed to viewpoints that align with their own. This selective exposure reinforces existing beliefs and limits the potential for deliberative democratic engagement. A 2020 study on echo chambers found that such environments deepen political divides and reduce empathy toward opposing views (Cinelli et al., 2020).

3. Research methodology

This study is based on a quantitative approach aiming to explore voter behavior in the context of the Romanian presidential elections scheduled for April 2025. The main objective is to assess the degree of electoral mobilization, voting intentions, and the various psychological, social, and media-related factors that influence the decision to vote. Data was collected using a structured questionnaire, which included both closed and semi-open questions targeting voting participation, candidate preference, and motivation for electoral engagement.

The research was conducted on a sample of 1001 individuals, selected to reflect the socio-demographic diversity of the Romanian voting population. The sampling method ensured representativeness across variables such as age, gender, education level, and geographical distribution. The data collection process took place through online survey methods during the pre-election period, allowing for the analysis of real-time electoral attitudes in a politically dynamic context.

The questionnaire design was guided by existing theoretical models in political science and voter behavior, such as the Columbia and Michigan models, and it aimed to capture both rational and emotional determinants of voting. Variables such as perceived civic duty, political efficacy, ideological orientation, media trust, and social influence were operationalized and measured through Likert-type scales and single-choice questions. Analytical methods included frequency distribution analysis, comparative interpretation of response categories, and correlation assessment between key behavioral indicators.

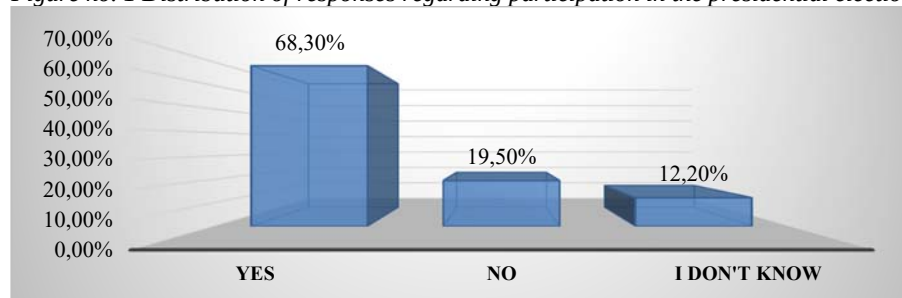
The methodology adopted offers both a snapshot of current electoral predispositions and a foundation for predictive insights regarding voter turnout and preference formation in the upcoming elections. It also contributes to a broader understanding of democratic engagement and the evolving role of political communication in shaping voter decisions.

4. Findings

Voter turnout is a key indicator of citizens' engagement in a democratic system. In the context of the presidential elections scheduled for April 2025, understanding the level of electoral mobilization and the intention to participate in the vote becomes a central concern in the analysis of voter behavior. The present study aims to highlight the Romanian electorate's attitude toward voting participation, by analysing the responses of a sample of 1001 individuals to the question: "Will you participate in the presidential elections in May 2025?"

The results show that 68.3% of respondents stated they intend to vote, while 19.5% said they would not, and 12.2% remain undecided. These figures suggest a positive predisposition toward democratic engagement, comparable to turnout levels in previous presidential elections. At the same time, the 12.2% of undecided respondents represent a volatile group, susceptible to influence from electoral campaigns and socio-political dynamics in the lead-up to the election. Those who declared they would not participate (19.5%) may reflect a lack of trust in the political system, disinterest, or other forms of civic alienation that deserve further investigation.

Figure no. 1 Distribution of responses regarding participation in the presidential elections

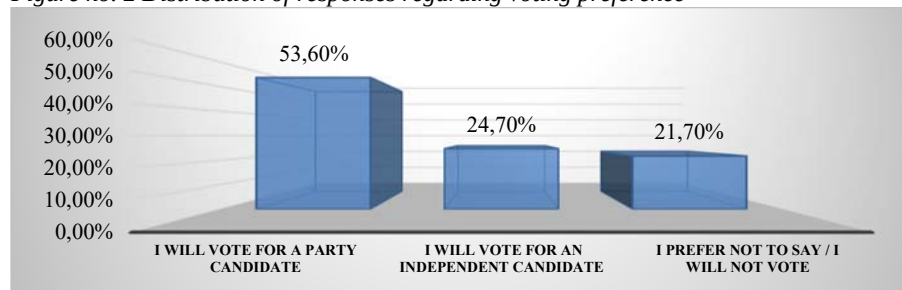


Source: Authors' contribution

The analysis of electoral behavior is not limited to the intention to vote, but also targets the specific voting options expressed by citizens. In this regard, the question concerning how respondents intend to vote in the May 2025 presidential elections provides valuable insights into electoral preferences. The answers reflect the degree of political polarization, support for existing parties, or openness to independent alternatives.

Based on a sample of 1001 individuals, the distribution of responses is as follows: 53.6% stated that they would vote for a party-affiliated candidate, 24.7% said they would vote for an independent candidate, and 21.7% declared they would not vote or preferred not to express their choice. The results suggest a majority inclination toward party-supported candidates, while also indicating a notable level of support for independents—highlighting a significant potential for protest voting or a preference for figures perceived as outside the traditional political system. The 21.7% share represents an area of uncertainty, which may be explained by a lack of trust, indecision, or reluctance to express a clear political opinion.

Figure no. 2 Distribution of responses regarding voting preference



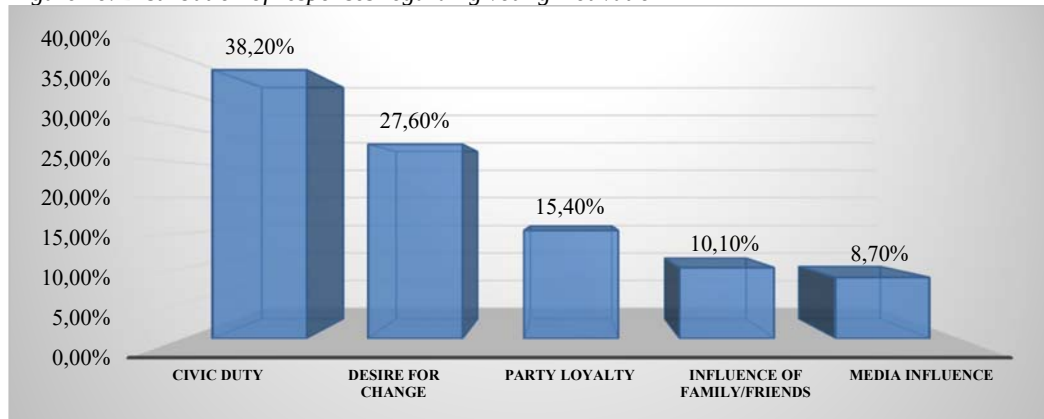
Source: Authors' contribution

Understanding the motivations behind voting participation is essential to grasp the deeper nature of electoral behavior. The question "What is the main reason why you will vote?" provides valuable insights into the values and factors that drive voters to take part in elections.

The results indicate that civic duty emerges as the leading motivation, being selected by 38.2% of respondents. A significant portion, 27.6%, identified the desire for political change as their primary driver, while 15.4% mentioned loyalty to a political party. Other influencing factors include social influence—namely family and friends (10.1%)—and media exposure (8.7%).

These findings reflect a combination of internalized democratic norms, dissatisfaction with the current political context, and the influence of external social environments. They also suggest that electoral mobilization strategies should appeal not only to ideological alignment but also to voters' sense of responsibility and need for transformation.

Figure no. Distribution of responses regarding voting motivation



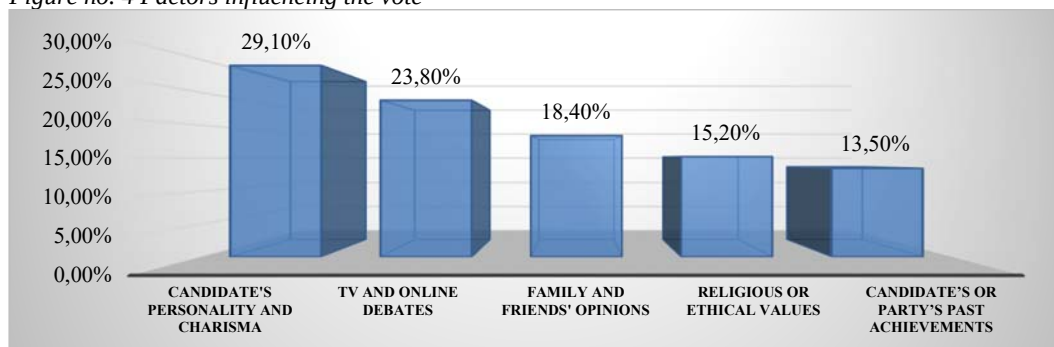
Source: Authors' contribution

Analysing the mechanisms behind voting decisions requires a closer look at the factors that shape voters' candidate preferences. The question "What most influences your vote?" investigates the personal, social, and ideological triggers that impact electoral choices.

According to the results, 29.1% of respondents are primarily influenced by the candidate's personality and charisma. Another 23.8% emphasized the role of TV and online debates, while 18.4% highlighted the impact of family and friends. Additionally, 15.2% pointed to religious or ethical values, and 13.5% were guided by the candidate's or party's past achievements.

These findings underline the diverse and intersecting forces that drive voting behaviour emotional appeal, media narratives, interpersonal influence, and moral or historical evaluation. The data confirm that voters make decisions based on a complex mix of subjective perceptions and perceived credibility.

Figure no. 4 Factors influencing the vote



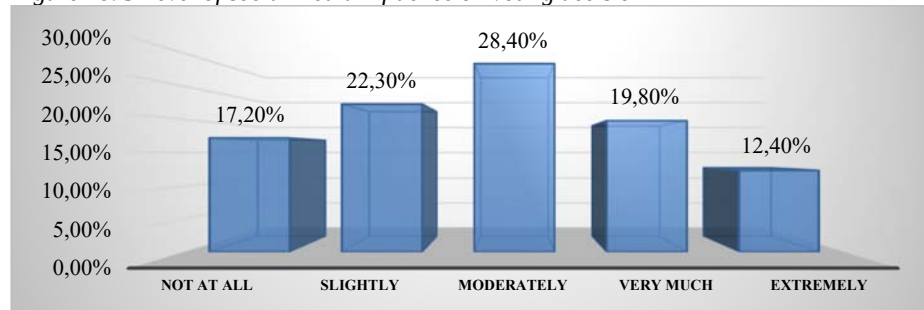
Source: Authors' contribution

As social networks increasingly shape public discourse, their role in influencing voting behavior has become more prominent. The question regarding the impact of digital platforms on electoral decisions explores how respondents perceive this form of influence.

The results reveal that 28.4% of individuals feel moderately influenced by social media content, while 22.3% report only a slight influence. In contrast, 17.2% state that these platforms have no impact on their decision. On the higher end of the spectrum, 19.8% indicate a strong influence, and 12.4% describe the impact as extreme.

This distribution illustrates a significant degree of digital influence, with more than 60% acknowledging at least some level of effect. While a portion of the population remains resistant or sceptical, the data confirm the growing relevance of social media as an opinion-shaping force in contemporary electoral dynamics.

Figure no. 5 Level of social media influence on voting decision



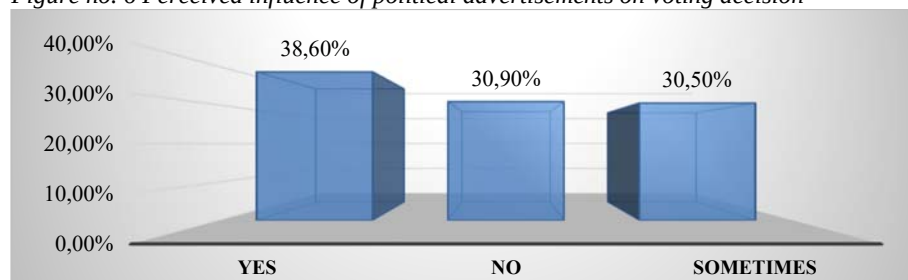
Source: Authors' contribution

In the context of an electoral landscape heavily marked by promotional content, evaluating the impact of political advertising on voting behavior offers valuable insight into voter receptivity. The corresponding question aimed to explore how respondents perceive the influence of such campaign tools.

The findings show a nuanced distribution of responses. A significant proportion, 38.6%, acknowledged that political ads influence their voting decisions. In contrast, 30.9% reported being unaffected by this form of messaging, while 30.5% stated that they are influenced only occasionally.

These results reflect the mixed effectiveness of political advertising while a notable segment of the electorate responds to these stimuli, an almost equal share either resists their influence or reacts selectively. This suggests that campaign strategies relying on advertising should be carefully tailored and complemented by more personalized or issue-focused engagement.

Figure no. 6 Perceived influence of political advertisements on voting decision



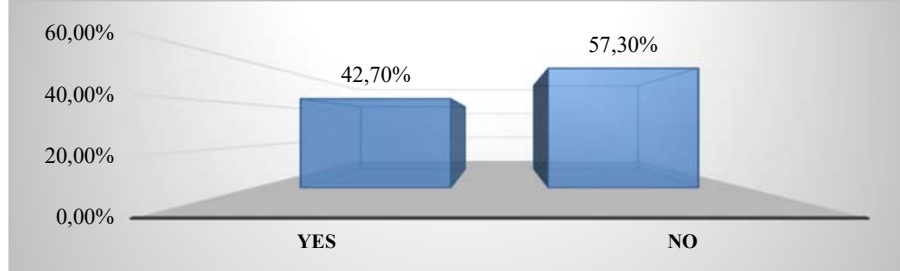
Source: Authors' contribution

The emergence of influencers and political commentators on digital platforms has introduced new, informal channels through which political opinions are shaped. This question explored the extent to which voters engage with these alternative sources of influence.

The responses reveal that 42.7% of participants report following such figures on social media, suggesting a substantial level of exposure to informal political content. On the other hand, 57.3% indicate that they do not engage with this type of commentary.

These results point to a divided media landscape, in which a notable share of the electorate supplements traditional information sources with content from non-institutional voices. The growing influence of such figures may play a strategic role in reaching segments of the population less responsive to conventional political messaging.

Figure no. 7 Share of respondents following influencers or political commentators on social media



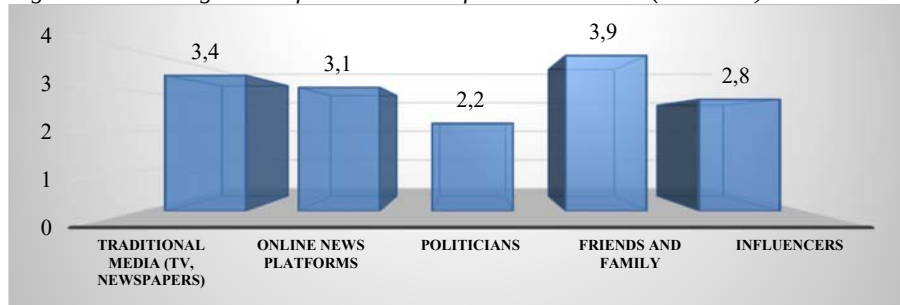
Source: Authors' contribution

Trust in information sources plays a central role in shaping political attitudes and voting intentions. This item assessed how various types of sources ranging from institutional to interpersonal are perceived in terms of credibility during the electoral process.

The results reveal a clear hierarchy of trust. Personal networks, such as friends and family, received the highest average score (3.9 out of 5), underscoring the enduring relevance of interpersonal influence. Traditional media also maintained a relatively strong position (3.4), followed by online news platforms (3.1). At the lower end of the spectrum, politicians were assigned the least trust (2.2), while influencers scored slightly higher (2.8).

These findings reflect a persistent scepticism toward institutional or self-interested sources and a greater reliance on familiar or established forms of communication. The data suggest that, despite the digitalization of political discourse, credibility remains closely linked to perceived authenticity and relational proximity.

Figure no. 8 Average level of trust in main information sources (scale 1–5)

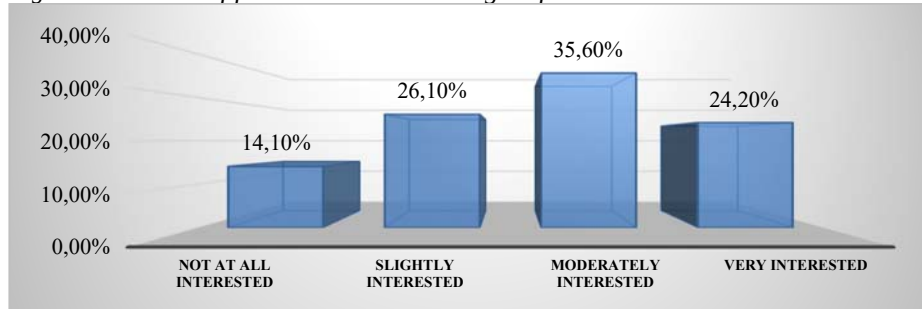


Source: Authors' contribution

The level of interest in politics is a fundamental indicator of civic engagement and participation in democratic life. This question aims to assess voters' general attitude toward politics, regardless of their actual voting behavior.

The distribution of responses shows that 35.6% of respondents declared themselves moderately interested in politics, while 24.2% reported being very interested. Another 26.1% indicated a low level of interest, and 14.1% stated they were not interested at all. These results suggest that, although there is a strong core of engaged citizens, a significant portion of the population remains distanced from political topics, which may affect participation and the quality of electoral decision-making.

Figure no. 9 Level of political interest among respondents

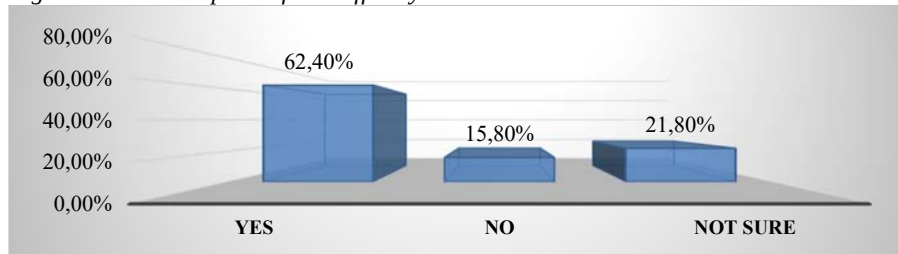


Source: Authors' contribution

Perception of voting efficacy is an essential indicator of trust in democracy. This question explores the extent to which citizens believe their vote makes a difference in the political process.

The majority of respondents (62.4%) believe their vote can make a difference, while 21.8% are unsure and 15.8% believe it has no impact. This distribution suggests a relatively positive level of trust in electoral mechanisms, but also a need to reinforce civic efficacy.

Figure no. 10 Perception of vote efficacy



Source: Authors' contribution

Ideological self-identification represents a key dimension in understanding electoral behavior, offering insights into how voters position themselves on the political spectrum. This question explored both declared orientation and the degree of openness in expressing political identity.

The responses reveal a dominant centrist tendency, with 29.7% of participants identifying at the center of the spectrum. Right-wing affiliation was declared by 22.5%, while 17.4% associated themselves with left-wing values. Additionally, 11.2% selected an alternative orientation, and a significant 19.2% opted not to disclose their ideological stance.

These results indicate a moderate ideological landscape, but also point to a degree of political reservation or disengagement. The relatively high percentage of respondents who abstained from self-placement suggests either a lack of identification with existing political categories or a reluctance to express personal convictions in a polarized environment.

Figure no. 10 Self-declared political orientation

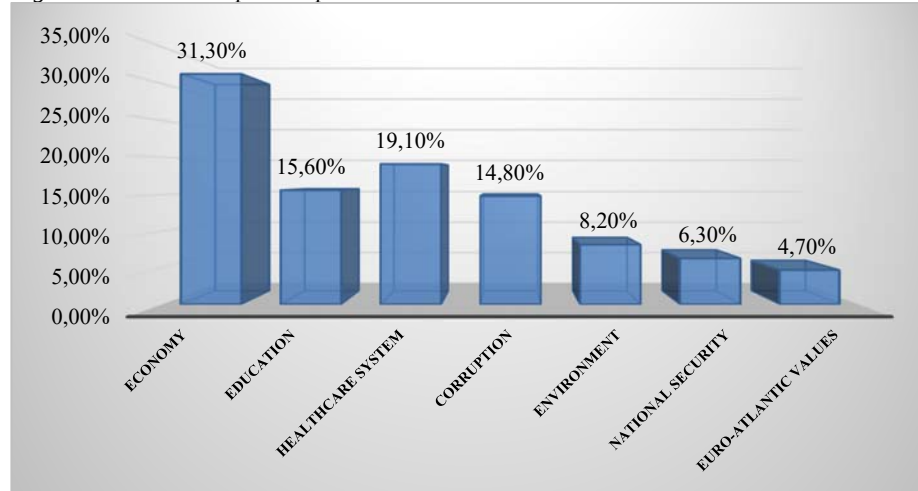


Source: Authors' contribution

This question aims to identify citizens' priorities in relation to the public agenda. The responses reflect the areas considered critical for the country's future.

The economy is seen as the most important issue by 31.3% of respondents, followed by healthcare (19.1%), education (15.6%), and corruption (14.8%). The environment (8.2%), national security (6.3%), and Euro-Atlantic values (4.7%) are mentioned less frequently, yet remain relevant for specific segments.

Figure no. 11 Most important perceived issues



Source: Authors' contribution

5. Conclusions

Overall, these studies converge on the idea that modern voter behavior is shaped by an interplay of rational assessment and emotional resonance, both of which are strategically targeted through political marketing. The use of digital tools, audience segmentation, and emotional storytelling has become essential in shaping how voters perceive candidates and make decisions at the polls. As political marketing continues to evolve, further research is needed to understand its long-term implications for democratic participation and the ethical boundaries of persuasive communication.

Voter behavior is a multifaceted phenomenon influenced by a wide range of psychological, social, and political variables. Over time, researchers have developed several models and theories to explain how and why individuals decide to vote for a particular candidate or party. This document synthesizes key findings from contemporary scientific literature, highlighting six main factors that shape voter behavior.

Voter behavior is shaped by a dynamic interplay of rational and emotional factors, identity, social influence, and strategic communication. Understanding these factors is essential for both scholars and practitioners of political science, particularly in an era where digital tools and media saturation increasingly mediate political engagement.

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The Influence of the Anchoring Effect on Buying Behavior in E-commerce

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Abstract

This paper explores the influence of the anchoring effect on consumer buying behavior in e-commerce, with a focus on how initial price displays shape product value perception. The study combines the theoretical foundations of behavioral economics with applied research based on a questionnaire completed by a sample of 130 respondents. Data analysis reveals that most consumers are affected by reference prices, often perceiving products as more valuable when a higher initial price is displayed and then discounted. At the same time, the results indicate an increasing awareness of the potentially manipulative nature of such pricing strategies and a more critical attitude towards online discounts. Respondents exhibit complex decision-making behavior, influenced not only by cognitive biases but also by social factors such as user reviews. This research contributes to a deeper understanding of online consumer behavior and provides practical insights for optimizing digital marketing strategies.

Key words: consumer behavior, anchoring effect, e-commerce, psychological pricing

J.E.L. classification: M31

1. Introduction

In recent decades, the rapid development of e-commerce has profoundly transformed the way consumers interact with products and make purchasing decisions. Unlike traditional shopping, where direct experience and physical interaction with the product play a central role, the online environment compels consumers to rely much more heavily on visual information, displayed prices, and user reviews. In this context, purchase decisions are influenced not only by rational factors, but also by subtle psychological mechanisms studied within the field of behavioral economics.

One of the most relevant mechanisms in this regard is the anchoring effect, which suggests that individuals tend to unconsciously rely on the first numerical information they receive especially the initial displayed price when evaluating the value of a product. This effect is frequently leveraged in digital marketing strategies through the use of “crossed-out” prices or visually striking discounts that create the perception of a better deal.

This paper aims to analyze the extent to which the anchoring effect influences consumer buying behavior in the online environment, combining a rigorous theoretical approach with empirical research based on a questionnaire administered to a relevant sample. The goal is to identify both the frequency with which this effect occurs in purchase decisions and the degree to which consumers are aware of the subtle influence exerted by the initial displayed price.

2. Literature review

Behavioral economics is an interdisciplinary field that combines economics and psychology to explain how individuals make economic decisions. Unlike traditional economic theory, which assumes that people act rationally and aim to maximize utility, behavioral economics demonstrates that decisions are influenced by psychological, emotional, and cognitive factors. The origins of this field can be traced back to early attempts to understand human behavior in economic contexts, although its development as a distinct discipline occurred in the second half of the 20th century.

Although behavioral economics is considered a relatively new field, concerns about understanding human behavior in economic contexts have their roots in the work of classical economists. Adam Smith, in his book *The theory of moral sentiments* (1759), discussed the influence of emotions, empathy, and social norms on economic decisions. While he is better known for *The Wealth of Nations* (1776), Smith already recognized in his earlier work that people are not purely rational and that emotions and subjective perceptions affect economic behavior.

Another influential thinker, John Maynard Keynes, introduced the concept of animal spirits in *The General Theory of Employment, Interest and Money* (1936), arguing that emotions and subjective expectations play a significant role in economic decision-making, particularly in relation to investments and economic fluctuations. Although these ideas were not formalized in behavioral terms, they anticipated many of the principles found in modern behavioral economics.

The theoretical foundations of behavioral economics were strengthened in the 20th century alongside advancements in psychology, particularly through the development of cognitive and experimental psychology. In the first half of the 20th century, psychologists such as Herbert Simon questioned the assumption of absolute rationality in individual decision-making. Simon introduced the concept of bounded rationality, suggesting that people do not make perfect decisions because they are limited by cognitive capacity and the availability of information (Simon, 1955). This concept became a cornerstone of behavioral economics, as it explains why individuals use heuristics (mental shortcuts) and why they often make suboptimal decisions in economic contexts.

Another crucial milestone in the development of behavioral economics was the research conducted by Daniel Kahneman and Amos Tversky, who demonstrated that people do not evaluate risks and probabilities objectively. In 1979, they introduced prospect theory, which explains how individuals perceive gains and losses asymmetrically losses are felt more intensely than equivalent gains. This discovery challenged the expected utility theory, which assumed that people make decisions strictly based on maximizing benefits (Kahneman & Tversky, 1979).

Prospect theory was revolutionary because it revealed that economic decision-making is not solely driven by rational thinking, but is significantly influenced by various cognitive biases that shape how people interpret information and assess risks and rewards. One of the most important phenomena supporting this perspective is the anchoring effect, described by Tversky and Kahneman (1974), which states that the first information received about a price or the value of an economic object heavily influences subsequent evaluations. For example, if a consumer initially sees a product priced high and later sees the same product significantly discounted, they are more likely to perceive the discount as advantageous than they would without that initial reference point.

This effect has substantial implications in e-commerce, where pricing strategies are deliberately structured to capitalize on this cognitive tendency. Subsequent studies have confirmed that users are likely to be influenced by initial reference prices, even when those prices are not objectively relevant to the product's actual value (Ariely et al., 2003).

Another fundamental psychological mechanism that influences economic behavior is the availability heuristic, explained by Tversky and Kahneman (1973). This phenomenon suggests that people make decisions based on the information that is most easily accessible in their memory, rather than considering the full range of relevant data. For example, consumers may avoid investing in stocks after being recently exposed to news of a market crash, even though historical data shows that investments tend to be profitable in the long term. The same principle applies to e-commerce, where products that have received recent negative reviews are often avoided by consumers, even if the majority of reviews are positive. This occurs because negative feedback is more mentally accessible and carries greater emotional weight in the decision-making process (Schwarz et al., 1991).

One of the most extensively studied phenomena in behavioral economics is loss aversion, formulated by Kahneman and Tversky in prospect theory (1979). This concept demonstrates that individuals are more motivated to avoid losses than to pursue gains of the same value. For example, losing 100 lei is perceived as more painful than the satisfaction gained from earning the same amount.

This asymmetry in risk perception explains why people tend to maintain the status quo and are reluctant to make changes, even when the potential benefits are evident. In the financial domain, loss aversion often causes investors to hold onto depreciating assets too long in the hope of recovery, while also making them overly cautious when it comes to taking necessary risks for capital growth (Barberis & Huang, 2001). In e-commerce, this principle is exploited through techniques such as limited-time offers or urgency-based messages, like "Buy now to avoid a price increase!" or "Only X items left in stock!". Studies show that these strategies significantly increase conversion rates by prompting consumers to act quickly to avoid a perceived loss (Frederick et al., 2002).

These phenomena clearly demonstrate that economic decisions are not purely rational but are influenced by subtle psychological factors that shape consumer perceptions and behavior. Understanding these mechanisms has not only revolutionized economic theory but also had a profound impact on fields such as marketing, finance, and public policy, offering new perspectives on how individuals respond to economic stimuli and surrounding information.

Ultimately, these mechanisms have shown that traditional economics, based on the assumption of a rational actor, does not fully capture the reality of human behavior.

Considering these theoretical concepts, the following section presents an applied analysis. The case study developed within this research is grounded in the concepts presented in the theoretical chapter, particularly regarding the anchoring effect described by Tversky and Kahneman (1974). The theory suggests that individuals tend to base their evaluations on the first available piece of information in the context of e-commerce, this refers to the initially displayed price of a product. Therefore, analyzing how consumers react to "crossed-out" prices becomes a concrete way to test the applicability of behavioral economic principles in an everyday context. The questionnaire and the interpretation of the results contribute to a better understanding of the extent to which this cognitive heuristic influences perceived value and purchasing behavior in the digital environment.

3. Research methodology

The main goal of this research is to analyze how the anchoring effect influences consumer buying behavior in the online environment. Specifically, the study aims to observe whether the initially displayed price (crossed-out or comparative) alters the perception of product value and influences the purchasing decision.

This is a quantitative study, based on the application of a structured questionnaire containing closed and semi-closed questions. The questionnaire was designed to reflect key theoretical concepts from behavioral economics, with emphasis on the anchoring effect, loss aversion, and the availability heuristic.

The instrument used was an online questionnaire, distributed via social media and digital platforms. It consisted of 17 questions exploring respondents' attitudes and reactions toward displayed price reductions in e-commerce, particularly toward crossed-out prices and reference pricing.

The research was conducted on a sample of 130 respondents, selected using a non-probabilistic convenience sampling method. Respondents were active users of online shopping platforms, aged between 18 and 55, from various socio-professional backgrounds.

The research was guided by several key objectives: to identify how frequently consumers are influenced by crossed-out prices or significant discounts, to analyze their level of trust in the authenticity of prices displayed online, to evaluate the role of the anchoring effect in shaping perceived value, and to determine the importance of additional factors such as product reviews, contextual cues, and message framing in the decision-making process. The data collected through the questionnaire were analyzed descriptively using basic statistical tools, including frequency distributions, percentage calculations, and graphical representations. The results were interpreted in relation to the initial hypotheses and in light of the theoretical framework provided by behavioral economics.

4. Findings

To investigate the influence of the anchoring effect on product value perception in e-commerce, a questionnaire was administered to a sample of 130 respondents. The anchoring effect, theorized by Tversky and Kahneman (1974), describes the tendency of individuals to rely on the first piece of information received (typically an initial price), which acts as a "reference point" that influences subsequent evaluations.

One of the key questions in the research focused on how respondents perceive a product when it is displayed with a crossed-out initial price and a lower current price. By analyzing the answers to this question, the study aims to determine the extent to which reference prices affect purchasing behavior and value perception in the digital environment.

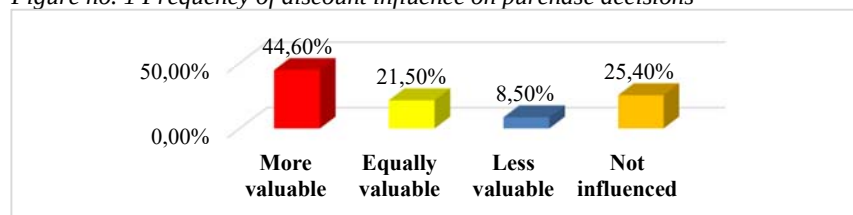
The results indicate that the anchoring effect is present to a significant degree among consumers. Specifically, 44,6% of respondents perceive the product as being more valuable when an initial (higher) price is displayed and crossed out, compared to when only the final price is shown.

This perception supports the hypothesis that the reference price acts as a cognitive anchor, influencing the way consumers assess the product's value. Essentially, the higher initial price prompts a mental comparison that gives the reduced price a higher perceived value, even though the product itself remains unchanged.

On the other hand, 25,40% of respondents state that they are not influenced by the display of the original price, while 21,50% consider the product equally valuable regardless of the pricing format. These percentages suggest the presence of a more rational or marketing-aware segment of the population, who do not assign greater value based solely on the visual presentation of price.

A small proportion, 8,50%, even report perceiving the product as less valuable when shown with a discounted price possibly due to skepticism about the product's quality or the authenticity of the discount (e.g., "too cheap to be good").

Figure no. 1 Frequency of discount influence on purchase decisions



Source: Authors' contribution

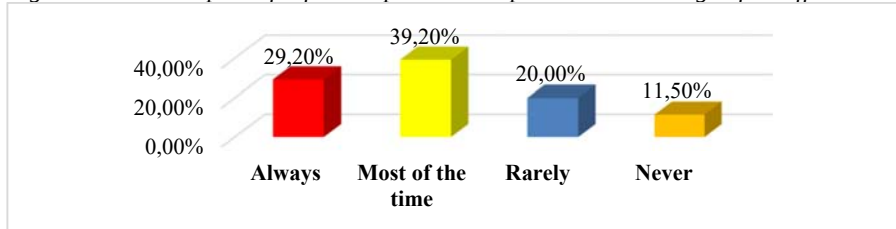
To better understand the depth of the influence that commercial strategies have on consumer behavior, the questionnaire included a question regarding the frequency with which respondents are influenced by discounts displayed online. This question aims to quantify the overall impact of discounts on purchasing decisions, beyond the perceived value of the product.

The results show that a significant proportion of consumers are sensitive to the presence of discounts. Specifically, 29,20% of respondents stated that they are always influenced by discounts, while 39,20% admitted they are influenced most of the time. Taken together, nearly 69% of participants indicate a high predisposition to react to reduced prices, which highlights a fertile ground for the triggering of impulsive or emotionally driven buying behavior.

On the other hand, 20% reported that they are rarely influenced, and 11,50% stated that they are not influenced at all. This segment may reflect either a higher level of experience in the digital environment or a more rational and deliberate attitude toward marketing stimuli.

The distribution of responses suggests that while the anchoring effect and the psychological pressure created by discounts are widespread, there remains a segment of consumers who exhibit caution or skepticism toward such commercial messages.

Figure no. 2 The impact of reference price on the perceived advantage of an offer



Source: Authors' contribution

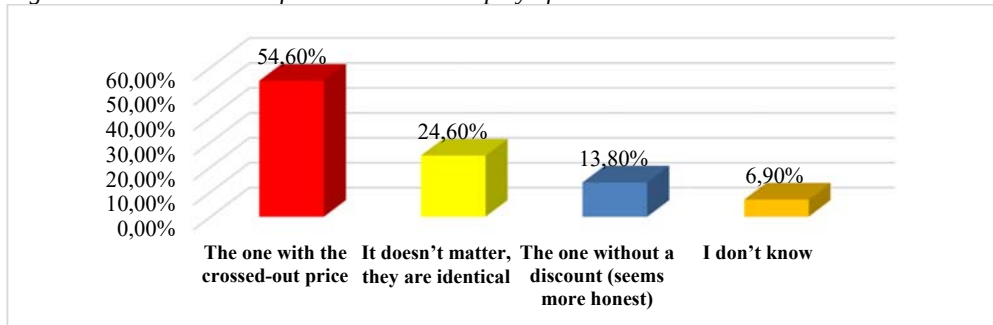
To directly test the applicability of the anchoring effect in a comparative scenario, respondents were asked to choose between two identical products, one of which had a crossed-out initial price. This exercise provides a clear illustration of how the reference price influences value evaluation.

The majority of participants, 54,60%, indicated that they would consider the product with the crossed-out price to be more advantageous, even though it was identical to the product without a discount. This result supports the hypothesis that the first numerical cue in this case, the initial price creates a mental reference point that influences perceived value and purchase decisions.

Another 24,60% of respondents considered the two products to be equivalent, indicating a more analytical understanding of the context and a certain resistance to manipulation through reference pricing. Interestingly, 13,80% of participants perceived the product without the discount as more honest or credible, suggesting a degree of skepticism toward the authenticity of price reductions. Only 6,9% admitted they could not accurately evaluate the advantage of the offer.

These findings highlight that although the anchoring effect strongly shapes general perceptions, there is still a considerable portion of the population that adopts a critical or independent stance toward pricing strategies.

Figure no. 3 Distribution of reactions to the display of a 40% discount



Source: Authors' contribution

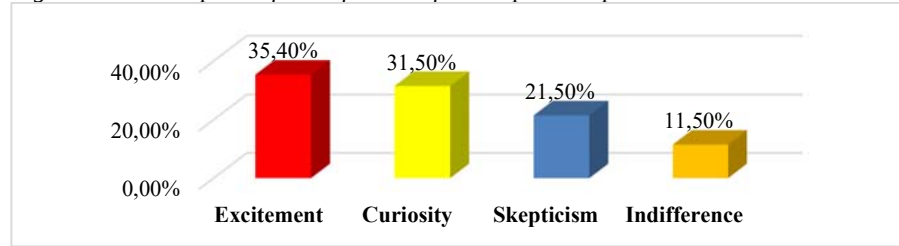
As part of the research, the immediate emotional reaction of consumers to significant percentage discounts was also examined. Large percentage discounts such as 40% are frequently used in e-commerce to attract attention and stimulate quick purchasing decisions.

The results indicate that 35,40% of respondents feel excited and motivated to buy immediately when seeing a 40% discount, while another 31,50% state that they become curious and begin to analyze the offer. This combination shows that two-thirds of participants exhibit a positive initial reaction, which may lead to an emotionally driven purchase decision.

In contrast, 21,50% of respondents express skepticism, reflecting a more reflective attitude and an awareness that deep discounts are not always genuine. A further 11,50% report that they are not affected by such discounts, which may suggest either a natural resistance to commercial influence or prior negative experiences.

These varied reactions suggest that large percentage discounts trigger strong emotional impulses in the majority of consumers. However, there remains a minority that adopts a rational or cautious approach, potentially reducing the effectiveness of such techniques among certain audience segments.

Figure no. 4 Perception of the influence of initial price on purchase decision



Source: Authors' contribution

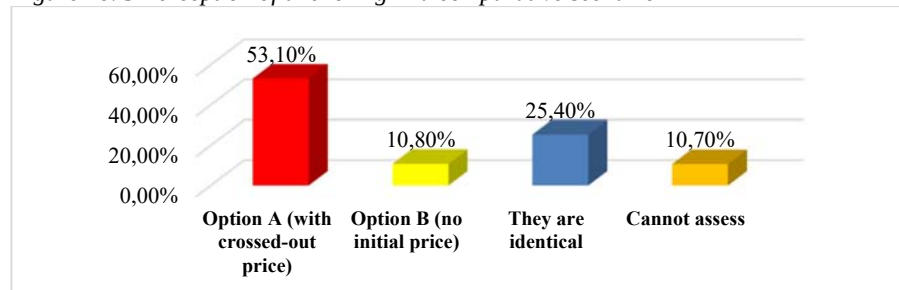
To concretely test the anchoring effect in a realistic scenario, respondents were presented with a hypothetical situation in which two identical products were shown at the same final price, but only one included a higher, crossed-out initial price. This question aimed to capture the reaction to reference pricing and how it influences the perception of which offer is more advantageous.

The results confirm the impact of cognitive anchoring on decision-making behavior. Over half of the respondents (53,10%) considered Option A - the product with the crossed-out price as the better deal, despite both options having the same final price. This outcome strongly supports the hypothesis that the initial price acts as an anchor that shapes value perception, leading consumers to perceive significant savings even when the product's intrinsic value has not changed.

A notable 25,40% stated that they viewed both offers as identical, suggesting a higher level of awareness regarding the psychological influence of reference pricing. Additionally, 10,80% said they could not assess the difference, while another 10,70% preferred the version without the initial price, possibly reflecting a critical or skeptical attitude toward commercial discount presentation techniques.

Overall, the question highlights a clear preference for offers that include a visual anchor in the form of a crossed-out initial price, while also revealing the presence of consumer segments that exhibit resistance or rational analysis in response to such tactics.

Figure no. 5 Perception of anchoring in a comparative scenario



Source: Authors' contribution

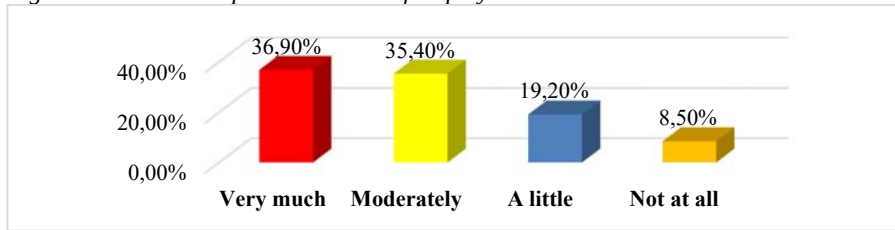
To complete the analysis of the anchoring effect, a question was included regarding the subjective perception of how much the initial price influences the purchasing decision. The purpose of this question was to assess the respondents' awareness of their own vulnerability to this psychological effect.

The distribution of responses shows that an overwhelming proportion of participants acknowledge a significant influence of the initial price on their buying behavior. Specifically, 36,90% stated they are influenced "very much", while 35,40% reported a "moderate" influence. This awareness suggests that most consumers recognize the impact of displaying a higher initial price, even if the effect operates automatically and is not always consciously rationalized.

A further 19,20% believe that the initial price influences their decision "a little", while 8,50% claim to be not influenced at all. These figures may reflect either a strong confidence in their analytical skills or a general distrust of discount strategies, but they remain a minority compared to the percentages confirming the effect's presence.

In conclusion, the responses to this question support the finding that anchoring through initial pricing is not only effective, but also acknowledged as influential by most consumers further validating the theoretical robustness of the anchoring effect in a real-world context.

Figure no. 6 The manipulative nature of displayed discounts



Source: Authors' contribution

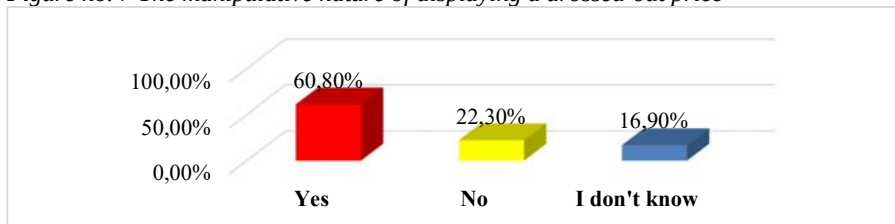
To complement the analysis of consumer perceptions regarding commercial strategies used in e-commerce, respondents were asked to express their opinion on the potentially manipulative nature of displaying a crossed-out initial price. This question aimed to reveal the extent to which consumers are aware that such practices may be used to influence purchasing decisions, even in the absence of a real discount.

The majority of respondents (60,80%) consider the display of a crossed-out price to be a manipulative technique, highlighting a high level of critical awareness regarding how discounts are presented in the online environment. This result may indicate a decline in trust in the authenticity of discounts frequently promoted on e-commerce platforms, as well as a more nuanced understanding of how psychological marketing operates.

A smaller percentage (22,30%) stated that they do not consider this strategy to be manipulative, which may suggest either acceptance of this approach as a standard and transparent commercial practice, or greater trust in the legitimacy of online offers. Additionally, 16,90% of participants reported that they do not know or cannot assess the manipulative nature of this method, which may reflect either a lack of interest or a difficulty in evaluating merchants' intentions beyond appearances.

Therefore, this question contributes to shaping a broader picture of the level of commercial and critical literacy among modern consumers. Even though the anchoring effect often functions automatically and unconsciously, a significant portion of the public appears to recognize the mechanisms through which value perception is intentionally influenced.

Figure no. 7 The manipulative nature of displaying a crossed-out price



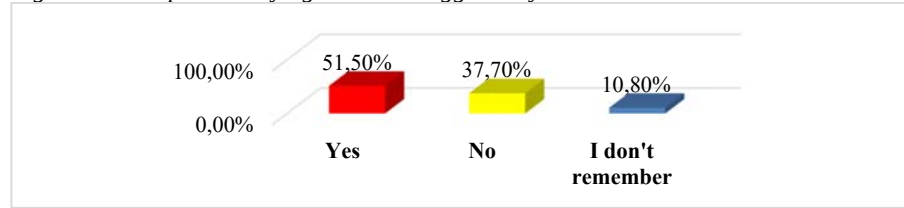
Source: Authors' contribution

The following question aims to identify impulsive purchasing behavior triggered solely by the stimulus of a discount, even in the absence of a real need. The goal is to evaluate whether the display of a significant price reduction can lead to emotionally driven and objectively unjustified purchases.

More than half of the respondents (51,50%) acknowledged that they had purchased a product at least once solely because of the displayed discount, despite not having a real need for it. This behavior supports the hypothesis that a reduced price acts as an emotional trigger, surpassing economic rationality. On the other hand, 37,70% stated that they were not influenced in this way, while 10,80% said they could not recall their exact behavior possibly indicating a low level of awareness regarding their own purchasing decisions.

These results highlight both the effectiveness of discounts as a sales conversion tool and the potential risk of promoting irrational consumerism.

Figure no. 8 Impulsive buying behavior triggered by discounts



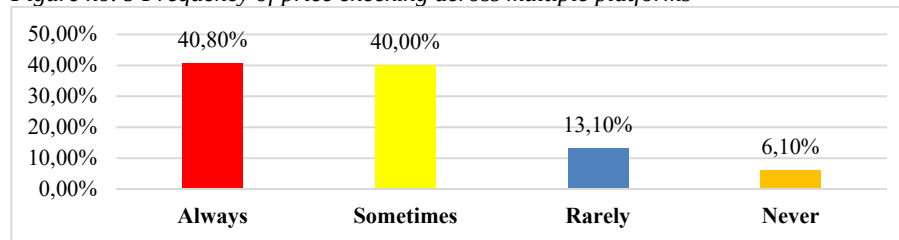
Source: Authors' contribution

The level of trust attributed to the displayed reference price, an essential element in perceiving a product's value, completes the anchoring analysis.

Only 13,10% of respondents declared themselves to be very confident in the accuracy of the initial displayed price, while 30% reported having fairly high confidence. On the other hand, 36,90% stated they had little confidence, and 20% had no confidence at all. These results suggest a clear trend of skepticism toward the authenticity of reference prices in the online environment.

Nevertheless, even under conditions of limited trust, the anchoring effect remains active, which demonstrates its cognitive strength in influencing purchasing behavior, even among cautious consumers.

Figure no. 9 Frequency of price checking across multiple platforms



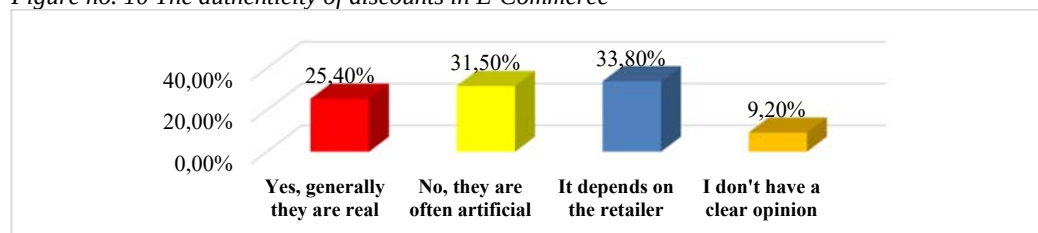
Source: Authors' contribution

In the context of commercial strategies frequently used in e-commerce, it is essential to understand how consumers perceive the authenticity of displayed discounts. The perception of the truthfulness of these discounts directly influences trust in sales platforms and, consequently, purchasing behavior.

An analysis of the responses shows that only 25,40% of participants believe that discounts generally reflect a real decrease in the product's value. In contrast, 31,50% consider them often artificial, while 33,80% offer a more nuanced view, stating that it depends on the retailer. A further 9,20% did not express a clear opinion, which may indicate uncertainty or a lack of interest in this aspect.

This distribution of responses indicates a high level of caution and even distrust toward commercial discount messages. Although anchoring, as a cognitive mechanism, continues to influence purchase decisions, its effectiveness appears to diminish among consumers who adopt a more rational and analytical approach. Limited trust in online discounts is likely an adaptive response to previous experiences with exaggerated or misleading offers.

Figure no. 10 The authenticity of discounts in E-Commerce



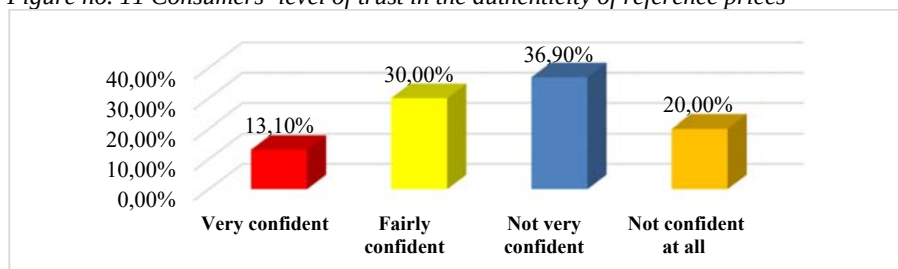
Source: Authors' contribution

Trust in the authenticity of the initial displayed price is essential in the context of e-commerce, where price reductions are often used as a marketing strategy. The question targets consumers' perception of the truthfulness of the reference value presented in online offers.

Only 13,10% of respondents declared themselves very confident that the initial displayed price is real, while 30% stated they have moderate confidence. In contrast, 36,90% reported having little confidence, and 20% said they have no confidence at all. These results highlight a predominantly skeptical attitude toward pricing practices in e-commerce.

Although the anchoring mechanism operates at a subconscious level, consumers are becoming increasingly aware that initial prices can be artificially inflated to enhance the perceived value of a discount. This low level of trust may negatively impact the effectiveness of such strategies, particularly among more informed consumers.

Figure no. 11 Consumers' level of trust in the authenticity of reference prices

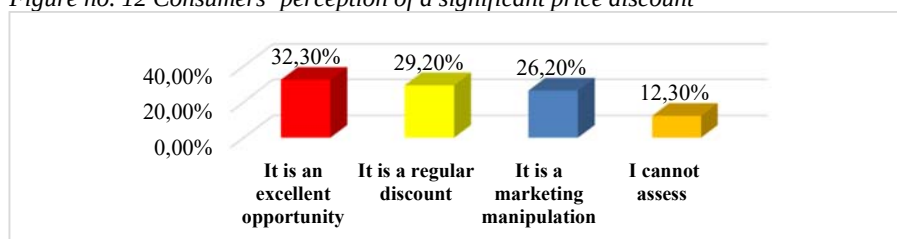


Source: Authors' contribution

A significant price reduction, such as a drop from 799 lei to 499 lei, can generate various reactions from consumers. The data show that 32,30% of respondents perceive such an offer as an excellent opportunity, while 29,20% consider it a typical discount. On the other hand, 26,20% interpret it as a possible marketing manipulation, and 12,30% state that they cannot properly evaluate the situation without additional information.

This balanced distribution between trust and skepticism highlights the fact that, although large discounts can trigger enthusiasm and purchase intention, they are not automatically accepted as authentic. Nearly a third of respondents question the honesty of such a price drop, reflecting the evolution of critical consumer behavior. Even when the scenario appears attractive, buyers seem to adopt an analytical and cautious attitude, consciously assessing whether the offer represents real value or is the result of a persuasive marketing strategy.

Figure no. 12 Consumers' perception of a significant price discount



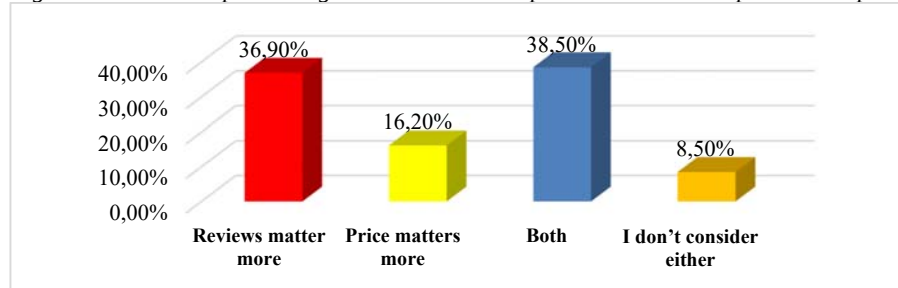
Source: Authors' contribution

In the context of online shopping, consumers are simultaneously exposed to both price discounts and user feedback. This question explores buyer priorities: do they respond more strongly to price stimuli, or do they place greater value on social trust?

38,50% of respondents stated that they try to balance price and reviews, while 36,90% consider reviews more important than price. Only 16,20% prioritize price, and 8,50% do not consider either reviews or cost. The results suggest that trust in the experiences of other consumers plays a key role in the decision-making process, sometimes outweighing the impact of a price discount.

This tendency indicates a maturation of online consumer behavior, where social factors and perceived product quality become essential criteria in the final choice.

Figure no. 13 The importance given to reviews compared to discounted price in the purchase decision



Source: Authors' contribution

5. Conclusions

The present study confirms that the anchoring effect plays a significant role in shaping consumers' perceptions and decisions in the context of online shopping. The results demonstrate that a large proportion of respondents are influenced by initial reference prices, particularly when discounts are visually emphasized. More than half of participants perceived identical products as more valuable when a higher, crossed-out price was displayed, validating the hypothesis that early exposure to numerical values skews evaluation and contributes to the perceived attractiveness of an offer.

Despite the clear evidence of the anchoring effect, the study also reveals that a substantial portion of consumers maintain a rational or skeptical approach toward such pricing strategies. Some respondents explicitly reported that they were either unaffected by reference prices or even distrusted heavily discounted products. This highlights the growing awareness and digital maturity among online shoppers, which may serve as a natural limitation to the effectiveness of psychological pricing tactics in the long term.

From the perspective of validity and credibility, the research employed a structured questionnaire based on well-established theoretical constructs in behavioral economics. However, as with any self-reported data, results may be subject to response biases, such as social desirability or overestimation of rational behavior. Moreover, the use of a non-probabilistic convenience sample limits the generalizability of the findings to the broader population.

Nevertheless, the study provides valuable insights into how pricing strategies rooted in behavioral theory operate in real-world e-commerce contexts. The anchoring effect, combined with other cognitive heuristics such as loss aversion and the availability bias, continues to shape how consumers interpret value and make decisions under uncertainty.

Future research could expand on this work by comparing results across different demographic groups, types of products, or cultural contexts. It may also prove useful to complement the current quantitative approach with qualitative methods, such as interviews or focus groups, to gain a deeper understanding of the reasoning behind consumer choices.

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About Ethical Management in Justice Activity

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Abstract

The article explores the importance of ethical management in the activity of the judicial system, highlighting the essential role of integrity for the legitimacy of decisions and the proper functioning of these institutions. The primary purpose of the research is to assess how ethical management can be strengthened through legislative, organizational, and cultural measures, promoting a culture of responsibility, transparency, and mutual respect. It also analyzes the challenges encountered in implementing these practices, such as political influence, resource shortages, and excessive bureaucracy, emphasizing the importance of continuous training and civil society involvement in monitoring justice. By adopting these measures, the aim is to improve the efficiency and legitimacy of the judicial system, ensuring ethical professional conduct and fostering public trust in the act of justice.

Key words: ethics, ethics management, ethical organizational culture

J.E.L. classification: A130

1. Introduction

For the first time, a member of the Superior Council of Magistracy wrote, in 2011, about ethical management in courts, and he assessed the moral evolution of the Romanian justice system as "between amoral and reactive".

The author's conclusion is that it is much easier to defend the independence of the judge against an external act, which is more visible, than against an operational management of the court but which, insidiously, can make the independence and impartiality of the collective of judges vulnerable in the long term, due to the lack of a reflexive exercise in the act of management, is fully valid. (Rădulescu, 2011)

Not even 10 years later, in a work on judicial management, a chapter entitled "Ethical aspects in judicial management activity" was introduced, in which, in two pages, several common ideas were presented about the gain that ethics would represent for the exercise of the act of leadership in courts and prosecutors' offices, "to the extent that it makes its way into discourse and decision (!)" and for the fulfillment of the mission of the judicial system, to achieve an efficient act of justice, in conditions of independence and integrity. (Rus, 2020)

2. Theoretical background

Ethics is a philosophical science that studies morality as one of the most important aspects of human and social existence. At the same time, ethics is also a scientific discipline.

Ethics was founded on various ethical conceptions of the guides of humanity: Confucius, Moses, Mohammed. Thus, Confucius (551-479 BC) proposes an idea that later becomes fundamental in philosophical ethics, namely that of saving humanity and renewing Antiquity. This is because during that era the empire was falling apart and Confucius' idea was to offer salvation to humanity through his advice. These advices were actually religious imperatives and rituals, which no longer had influence on humanity but were interpreted by him from the perspective of morality. Confucius argued that relationships between people become more harmonious only if they are reciprocal, the basis of humanity for Confucius representing respect for parents and esteem for older siblings.

Buddha (c. 560-480 BC) also had a great influence on human history. The Buddha's moral ideas emphasized humanity's compassion for everything around them. Moses' ethical conception consisted in the fact that the subject of ethics is the people, thus, according to Moses, the quality of ethics is precisely the ethics of equity. This is explained by the fact that, in itself, the individual's capacity to be equitable represents a test of the mind, power and beauty of man. Muhammad's ethical conception was represented through the Quran. The ethics of the Quran take into account the possibilities and circumstances of human life. For example, a Muslim is forbidden to eat pork, but if he happens to have nothing to eat except pork, then a derogation from this prohibition is allowed. Following this example, we can conclude that Muslim ethics also contains certain exceptions.

The moral motive is both the motive of wisdom and the motive of piety. From a philosophical point of view, ethics emphasizes the norms, principles, values, and moral ideals of those times.

For example, Socrates is the philosopher who founded the science of morality on the authority of theoretical reason, based on the maxim "Know thyself". He mentioned that self-knowledge is above all, and ignorance of self leads to the realization of our evils and vices. During his activity, Socrates managed to present the path, method, moral concepts and the statutation of the universal as the philosophical basis of moral science.

He considered that the given universal represents the moral virtue that allows the individual to know it, learn it and practice it at the same time. (Capcelea, 2004)

Epicurus, a philosopher from Ancient Greece, created an optimistic ethical conception that emphasizes the happiness of humanity, obtained through the satisfaction of pleasures and the avoidance of causes of suffering. Eudemonism, which represents happiness, is another ethical conception proposed by Epicurus and which is based on the human aspiration for happiness. Epicurus was convinced that the solution to the ethical problem lies precisely in the correct interpretation of the happiness of humanity. The ethical writings of Immanuel Kant, a German philosopher, mark human freedom and dignity. (Singer, 2006)

Kantian morality was established starting from a reflection on historical moral theories, from the observation that these theories could not substantiate the certainty of a lifestyle, of a code of behavior with a firm orientation, according to the principles of reason.

In this sense, V. Capcelea deduces that Immanuel Kant's ethical system is based on the conviction that reason is the highest instance of morality. (Capcelea, 2004)

Meditating on the meaning of life and the moral system of life, L. Tolstoy mentions that human life is filled with moral meaning to the extent that it obeys the law of love, conceived as nonviolence. Not to respond to evil with evil, not to resist evil with violence, was Tolstoy's exhortation regarding the life of humanity.

D. Gusti, a Romanian philosopher and ethicist, argues that "ethics is a science that addresses the problem of human will and that must take into account precisely this will". As a normative science, ethics, according to D. Gusti, refers to the valorization of social will as an activity, as a process of manifestation in order to appreciate goals. The major problem of ethics is the problem of motivation of the will, that is, the problem of personal goals and motives. Moral conscience does not represent only a feeling and judgment, but both together, in a reciprocal connection. Based on this, D. Gusti studies the mechanism and motivation of moral action and its teleological dynamism, arguing that a causal explanation is possible spiritually only for the facts that have occurred, not for those that are about to occur. Another problem in Gusti's ethics is the issue of the moral duties of personality, because in order to achieve its proposed objective, practical ethics must discover the principles and moral duties that underlie the realization of personality.

3. Research methodology

In the investigative approach regarding ethical management in courts, the research was structured around a mixed methodology, combining elements of qualitative and quantitative research, to capture both normative and institutional aspects, as well as the perceptions and practices of the actors involved in the act of justice.

The main objective of the research was to identify the ways in which the principles of professional ethics are implemented within the courts, as well as the challenges faced by magistrates and auxiliary staff in their application.

To achieve the objectives, the following methods were used:

- Documentary analysis: codes of ethics, internal regulations, best practice guides, decisions of the Superior Council of Magistracy, as well as reports of international organizations (e.g. GRECO, CEPEJ) on integrity and ethics in the judicial system were analyzed.
- Semi-structured interviews: 10 interviews were conducted with judges, clerks and legal advisors, selected based on a convenience sample from four Romanian courts. The interviews aimed to explore perceptions of the institutional ethical culture, frequent moral dilemmas and the efficiency of mechanisms for preventing misconduct.
- Online questionnaire: applied to a number of 15 respondents from the judicial system (judges, prosecutors, clerks), with the aim of quantifying attitudes towards ethical norms and identifying possible discrepancies between rules and practices.

Combining these methods allows for data triangulation and a more complete picture of the issue at hand. In addition, the qualitative approach facilitates understanding of ethical contexts and nuances that cannot be captured by strictly quantitative methods.

The research is limited by the relatively small number of respondents, the subjective nature of qualitative data, and the reluctance of some participants to openly discuss sensitive issues. However, the results provide valuable insights into the current state of ethical management in courts and may constitute a starting point for more extensive future research.

In Romania, the foundations of the analysis of ethics in organizations – seen as institutional ethics for the needs of an organization, not for personal needs – were laid by Professor Valentin Mureșan, who founded the Center for Research in Applied Ethics of the University of Bucharest in 2004 and “was an important promoter of the field of moral philosophy and ethics... and its most dedicated supporter in the last thirty years” with a “tireless involvement in the construction of ethical infrastructures – ethics committees and codes, methods and procedures for moral decision-making, etc.”

According to Professor Mureșan, ethical management of organizations aims at the management of all activities that structure the moral life of an organization, and its goal is to create moral or integrity organizations, which possess internal organizational structures that are able to stimulate the moral behavior of personnel and inhibit immoral behavior. (Mureșan, 2009)

Judicial management represents the set of activities through which the person invested in a management position determines the objectives of the judicial activity carried out within the court or prosecutor's office, makes decisions through which they organize activities, manage human resources, coordinate efforts and actions, train magistrates and other categories of personnel to participate in achieving the objectives, and control and regulate the functioning of the institution.

Within the judicial system, the manager is subject to constraints and limitations regarding the use of a toolkit fully applicable in organizations that do not fall within the scope of public authorities and which derive from the incidence of the principle of legality and independence of the judge.

In other words, unlike the private sector, within the judicial system, no matter how opportune or efficient a measure may seem, whether it concerns the organization of activity, communication or motivation of personnel, the manager will only be able to implement it if the legal provisions allow this and do not prejudice the principles governing the organization of the judicial system.

Management is a "whole" that includes five main functions: planning, organizing, coordinating, coaching, and evaluating/controlling.

Ethics in judicial management represents the coherent set of ethical norms and principles to which the conduct of persons exercising management positions in courts and prosecutors' offices must be subordinated, in order to make fair decisions.

In the judicial system, ethics is of strategic importance since integrity is essential for the proper performance of the judicial function, and the legitimacy of the decisions rendered is conferred primarily by the moral authority and integrity of the magistrates.

Therefore, the head of an institution in the judicial system must relate ethically to the duties of the position he holds and integrate ethics into all components of the activity of the courts and prosecutors' offices. He must also prioritize observance of professional ethics norms, which, moreover, also represent a criterion for assessing the efficiency, quality of activity and integrity of judges and prosecutors. (The Public Ministry)

4. Findings

The study on ethical management in courts highlights the essential role of ethics in strengthening public trust in the judicial system and in ensuring fair and impartial justice. The research results indicate that, although the existing normative and institutional framework provides solid support for the promotion of ethical behavior, the effective implementation of these principles remains uneven and often dependent on the organizational culture of each court.

A major conclusion is that judicial ethics cannot be treated as a simple set of rules, but as an integral part of institutional management, involving continuous training, periodic evaluation and clear feedback and correction mechanisms. Also, a better correlation between human resources policies, professional evaluation of magistrates and the promotion of ethical values is needed.

Based on the data analyzed, the need for increased transparency and strengthening ethical leadership at the level of court management is highlighted. The positive examples identified demonstrate that the existence of leaders who actively promote integrity has a direct impact on the institutional moral climate.

In addition, it is recommended to strengthen professional training with an ethical component, especially in the context of new challenges generated by external pressures, digitalization and increased visibility of the act of justice.

In recent years, discussions have intensified at European level on the need to approach judicial management in terms of efficiency and effectiveness. From perspectives focused on the professionalization of management, to discussions aimed at corporate governance, to the separation of the function of representing the jurisdiction from any specific management attribution, all of them recognize that the principles and functions of management must become structural elements of the way of leadership in courts and prosecutors' offices. It is obvious that the reality of activity in the judicial system confirms the need for professionalized leadership on two levels of intervention, that of management and that of judicial activities. (National Institute of Magistracy., 2021)

The analysis revealed that implementing effective ethical management depends on key factors: professional leadership within judicial institutions, the existence of clear and applicable ethical codes, and efficient mechanisms for evaluating and sanctioning unethical behavior. In Romania, although there is a solid legislative framework, its implementation is inconsistent. Issues such as political influence, lack of resources, and excessive bureaucracy negatively affect organizational ethics. In contrast, some other countries have successfully implemented clear procedures for reporting unethical behavior and have fostered institutional cultures based on integrity.

5. Conclusions

Undoubtedly, the head of an institution represents its moral benchmark and, through the way he exercises his function and relates to the values specific to the profession, influences the moral life of the institution he leads. He must be aware that his mission is to promote and maintain high standards of professional conduct. It follows, therefore, that the moral commitment of the head of an institution should be stronger than the commitment as a simple member of staff.

Therefore, it is important that he promotes a culture of ethical, responsible, transparent and public interest-oriented leadership. At the same time, through the discourse promoted and the decisions he makes, the manager must be an example of ethical conduct for the entire institution. In addition, the head of an institution in the judicial system must have a moral attitude consistent with the position he holds, treat people with respect and dignity, without favoritism, subjectivism and prejudice, and without publicly questioning their professional and moral probity.

Strengthening ethical management in the justice system requires an integrated approach that combines legislative, organizational, and cultural measures. Continuous ethics training, increased decision-making transparency, and civil society involvement in monitoring justice are essential. Recommended actions include: creating national ethical standards, establishing ethical performance indicators, and promoting an organizational culture rooted in responsibility and mutual respect.

The prioritization of justice work reflects current trends and threats to the rule of law in areas of interest, such as: economic and financial field, cybersecurity, combating corruption, protecting and ensuring the integrity of the environment, involving complex measures and sustainable strategies for preventing risks and effectively combating these threats. Increasing the quality of the act of justice in all its components is also a priority, and the achievement of this objective is closely linked to the intensification of efforts to ensure faster and more efficient justice for citizens.

In conclusion, effective ethical management in courts requires not only compliance with the rules, but also proactive conduct, guided by responsibility, transparency and respect for citizens' rights. Only through an integrated and sustained approach can courts become models of integrity in public service.

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From Formal Certification to Authentic Leadership in Healthcare

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Abstract

The current certification system for healthcare managers in Romania is rigid and uniform, unable to respond to the diversity and complexity of leadership roles in public hospitals. This article examines the shortcomings of current managerial training, highlighting the lack of differentiation according to levels of responsibility and the absence of essential leadership skills. A curricular reform structured on three levels – operational, intermediate and strategic – is proposed, including micro-credentials, continuous assessment and the integration of digital technologies. The model aims to align with performance indicators in legislation and adopts international best practices, such as those of the NHS Leadership Academy and CCHL. The objective of the reform is the authentic professionalization of hospital management, through the development of adaptable, competent and results-oriented leaders. Through this reform, the Romanian health system could become more efficient, transparent and sustainable, significantly improving the quality of medical services.

Key words: healthcare management, leadership development, hospital certification, health policy reform, modular training

J.E.L. classification: I15, I18

1. Introduction

In Romania, access to management positions in public hospitals is officially regulated by normative acts that allow a wide spectrum of specialists – doctors, economists, lawyers to apply as managers of health units.

On paper, this interdisciplinary framework should support modern, diverse and high-performance leadership. The current training courses in hospital management organized by the National Institute for Health Services Management (INMSS) based on recent ministerial orders, are addressed to graduates with higher education interested in developing managerial skills and who want to apply for the position of hospital manager. However, the form of training offered is standardized and uniform, without clear differentiation on levels of managerial responsibility or on the specifics of the type of hospital.

The training of healthcare managers remains largely rigid and formal: it is carried out in the form of a single course of ~180 hours, which covers general management topics (management functions, hospital organization, human resources, public finances, quality of services, etc.), but does not sufficiently adapt to the complexity of the management position. The syllabus includes modules from general concepts of management and public finance to hospital quality management (e.g., nosocomial infections prevention) and crisis communication. These topics are necessary, but the unique curricular approach does not consider the differences between managing a small hospital or ward and a regional/university hospital.

Moreover, the current certification system does not emphasize strategic leadership development and lacks performance-based recertification. This results in a mismatch between practice and preparation – creating "front managers" instead of authentic leaders.

This paper aims to critically assess the current certification system for healthcare managers in Romania and to propose a new, modular, competency-based training model aligned with leadership principles and performance requirements.

2. Theoretical background

Romanian healthcare legislation (Law no. 95/2006 and Ministry of Health orders) stipulates that hospital managers must possess professional skills acquired through accredited courses.

Currently, these courses are built around general modules, focused primarily on theory, with a final management project, but lacking a clear emphasis on measurable outcomes. For instance, the "Hospital Management" refresher course (MS Order no. 126/2024) includes health reforms, population health assessment, service planning, DRG system, project and quality management, HR and financial oversight.

Despite the breadth, the training remains theoretical, lacking integration of digital tools or simulations, and omits periodic recertification tied to real results. There are no interactive simulations, digital portfolios, or ongoing curriculum revisions based on actual practice. Consequently, there's no guarantee hospital managers lead effectively, motivate teams, or handle crises well.

Scientific evidence supports the relevance of leadership in health services. Leadership interventions are linked to improved performance indicators and protocol adherence.

Ystaas et al. (2023) found that transformational leadership focused on staff needs positively impacts retention, morale, and satisfaction. A leader who engages and supports staff reduces turnover, boosts morale, saves resources, and enhances care quality.

A false equivalence has emerged: holding a manager's certificate is mistaken for possessing leadership capabilities. True healthcare leadership is visionary and strategic. Authentic leaders anticipate epidemiological and societal shifts, innovate internal systems, and inspire teams to achieve excellence.

Unlike reactive management, authentic leadership is adaptive, collaborative, and long-term focused. It strengthens communication, innovation, and resilience to crises like pandemics. International studies confirm that leadership development correlates with improved clinical care, organizational efficiency, and staff well-being.

Globally, successful programs like the NHS Leadership Academy (UK) and the Canadian College of Health Leaders (CCHL) reflect differentiated, tiered curricula tailored to roles. They focus on practical skills, outcomes, and continuous updates.

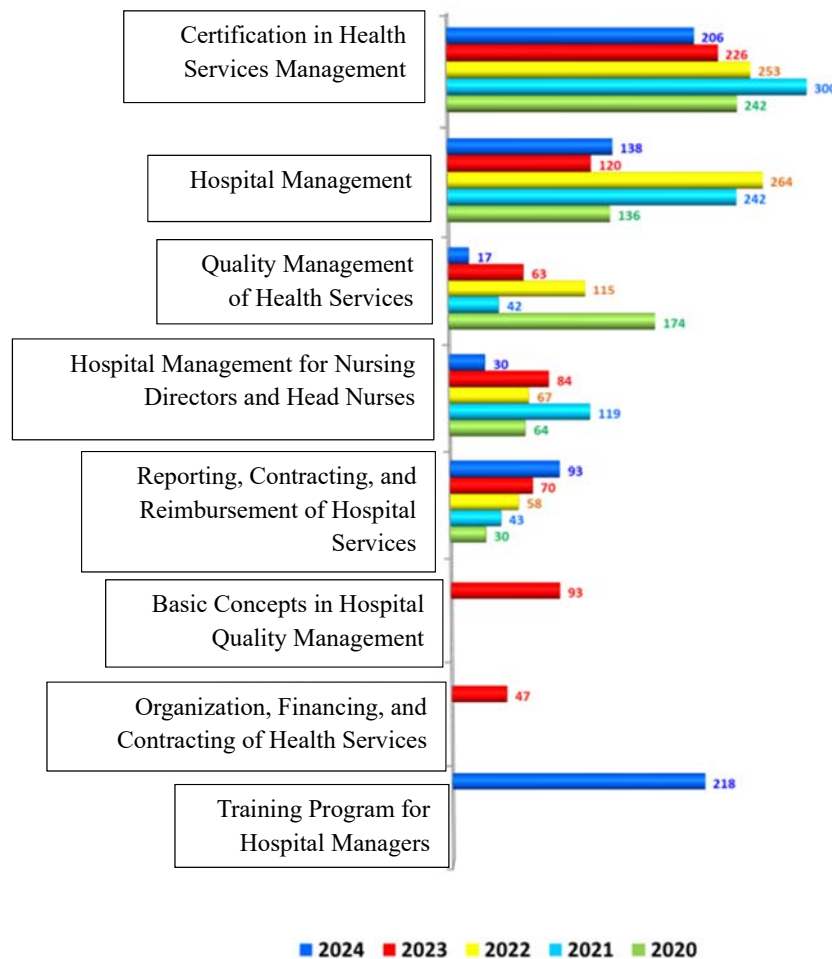
3. Research methodology

This article is grounded in conceptual analysis, policy review, and comparative benchmarking. It critically analyses Romania's regulatory framework, current INMSS curricula, and performance criteria under Order 3626/2022. International models (NHS UK, CCHL) serve as best-practice references. The proposal reflects insights from academic literature, institutional performance indicators, and organizational leadership theories.

4. Findings

MS Order no. 3626/2022 evaluates the performance of hospital managers based on five key dimensions: (A) Human Resources, (B) Service Utilization, (C) Economic Indicators, (D) Quality, and (E) Institutional Integrity. For managerial training to be truly effective, it must directly correspond to these criteria.

Figure no. 1 Number of participants by program types in the period 2020-2024



Source: National Institute of Health Services Management, 2024 Activity Report

Recent data from the 2024 INMSS activity report (Figure 1) illustrate the evolution of participation in managerial training programs in Romania over the past five years. The most attended program was the “Hospital Management” course, with 264 participants in 2023 and 242 in 2022, reflecting its widespread use as the de facto pathway toward healthcare leadership roles. However, the figures also highlight the uniformity of this training path, as more advanced or specialized leadership modules were significantly less attended.

For instance, the “Advanced Training Program for Hospital Managers” — which might be expected to offer tailored or strategic content — only appears in the data for 2024, with 218 participants. Other niche or technically specific courses, such as “Contracting and Reporting of Hospital Services” or “Quality Management in Hospitals,” had lower enrollment and variable consistency across the years.

These numbers confirm the central argument of this paper: despite the diversity of managerial needs, the current training ecosystem continues to rely heavily on a single, undifferentiated format. While participation in general management courses remains high, the lack of structured specialization by leadership level (operational, intermediate, strategic) remains a systemic gap.

Thus, the quantitative distribution of participants reinforces the urgency of curricular reform, especially in terms of modularity, flexibility, and alignment with the complexity of leadership roles in modern hospitals.

In the proposed reform model, the alignment is clearly structured: the module on human resources management and organizational leadership addresses the requirements under Section A.

The modules focusing on quality management and public communication are designed to meet the indicators outlined in Section D. Financial and strategic decision-making courses are correlated with Section C, while digitalization and artificial intelligence training correspond to Sections B and E. This integrated alignment shifts the course objective from a defensive stance of "avoiding mistakes" to a proactive orientation toward "leading effectively in a complex system."

Curricular Proposal

The reform proposes a three-tiered model of leadership development.

Level 1 (Operational) targets department coordinators, emphasizing direct team leadership, internal communication, applied ethics, and human resources at the service delivery level.

Level 2 (Intermediate) is designed for deputy managers or experienced leaders and includes institutional governance, public health policy, financial management, and organizational change.

Level 3 (Strategic) prepares top-level managers in large hospitals or public health institutions and focuses on transformational leadership, sustainability in healthcare, stakeholder engagement, and decision-making supported by emerging technologies.

Figure no. 2 Progressive Model of Managerial Training in Romanian Public Hospitals



Source: Authors' own elaboration

This structure is reinforced by modular learning and micro-certifications. Instead of a single, rigid 180-hour course, learner's complete short thematic modules — such as online workshops and simulation-based sessions — each resulting in a micro-credential for a specific skill (e.g., "Motivating Medical Teams" or "Strategic Hospital Budgeting").

The reform also introduces continuous evaluation and performance-based recertification. Participants develop a digital portfolio containing practical assignments, case studies, and decision-making simulations. Certification is granted based not only on a final exam, but also through 360-degree feedback from colleagues and partners, as well as tangible key performance indicators.

Certification remains valid for five years, after which recertification is based on proof of continued development, such as CPD (Continuing Professional Development) credits or demonstrable managerial improvement projects.

Digitalization and advanced simulations are central to the model, with tools such as AI-driven decision support, predictive modeling, and interactive crisis simulations that enhance real-world applicability and critical thinking.

Finally, the curriculum embeds ethical leadership and interdisciplinary access. It offers content on transparency, conflict-of-interest management, whistleblower protection, and the function of ethical councils. It also ensures access to non-medical professionals — such as economists,

engineers, IT experts, and policy analysts — who can contribute to strategic management through specialized modules.

International Inspiration

This proposed model draws from successful international practices. The NHS Leadership Academy (UK) provides a wide range of training programs tailored to career stages, from introductory online courses to comprehensive development programs for senior executives. Similarly, the Canadian College of Health Leaders (CCHL) offers the Certified Health Executive (CHE) credential, built upon the LEADS framework — currently the only dedicated healthcare leadership certification in Canada.

Benefits and Success Factors

The benefits of this model are multiple. It would professionalize hospital management by developing immediately applicable skills, while offering a flexible structure that saves time and reduces training costs.

By fostering transparent and capable leadership, the reform would also boost public confidence in healthcare governance and support evidence-based decision-making. Furthermore, it encourages stronger collaboration between government, academic institutions, and professional societies, stimulating applied research and the dissemination of best practices.

The success of this reform depends on several key factors: regular curriculum updates aligned with legislative and technological changes; the selection of experienced healthcare leaders as trainers; sustainable financing mechanisms, including European structural funds; and the recognition and support of these new certifications by public sector employers.

5. Conclusions

Romania can shift from formal credentialing to authentic leadership development. The reform would ensure managers possess practical, updated, and validated skills. This is not a luxury, but a strategic necessity. Aligned with legal performance standards and modern learning approaches, the model positions Romania as a regional leader in healthcare leadership. While promising, it requires pilot testing and evaluation to validate its feasibility and real-world impact. Leadership is essential for building trust, improving care quality, and guiding teams through complexity. In healthcare, effective leaders influence not only staff performance but also patient outcomes, institutional adaptability, and ethical culture. Especially in Romania, where systemic challenges persist, leadership is not optional it is foundational. Investing in real leadership development means equipping the system to respond to crises, retain talent, and evolve responsibly.

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Examining the Impact of Educational and Professional Environment Quality on Academic Achievement and the Outcomes of Integrated Quality Management Implementation

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Abstract

Schools today face increasing demands to improve instructional effectiveness and institutional performance. This study investigates how the quality of the educational and professional environment for teachers influences student academic outcomes and the success of integrated quality management systems in schools. Grounded in contemporary educational theories and supported by structural equation modeling, the research highlights the critical role of curriculum, infrastructure, teacher training, feedback, educational leadership, class size, assessment practices, quality assurance policies, and extracurricular opportunities. The findings demonstrate that these interrelated factors influence measurable academic outcomes and affect stakeholders' perceptions of educational quality. These results advocate for a systemic and sustained investment in the professional development of educators and the enhancement of school environments. Ultimately, the study confirms that the quality of the educational ecosystem is a key driver of both performance and perception, reinforcing the value of an integrated quality management approach.

Key words: educational quality management, teacher professional development, educational performance, quality assurance in education, learning environment

J.E.L. classification: I21

1. Introduction

The quality of education has become an essential strategic objective for education systems worldwide. Schools are challenged to improve their academic results and capacity to respond to the multiple expectations of students, parents, communities and authorities (Hattie, 2009). In this context, the fundamental role that the professional and educational background of teachers plays in generating performance and strengthening quality management is increasingly evident (Vărzaru and Vărzaru, 2013a, 2013b).

The literature highlights that factors such as teacher preparation, curriculum quality, educational leadership, infrastructure, quality assurance policies, and involvement in extracurricular activities can directly influence both academic achievement and perceptions of educational quality (Leithwood & Jantzi, 2006; Dweck, 2016; Hattie & Clarke, 2019). However, the complex relationships between these dimensions remain underexplored in an integrated framework.

Through a quantitative approach based on structural modeling, this paper aims to investigate how teachers' professional and educational background influences academic performance and the efficiency of quality management in schools.

2. Theoretical background

The school curriculum is the core of the educational process. According to Tyler (1949), a well-structured curriculum based on clear educational objectives relevant to the current context of society is essential for increasing the quality of learning and developing students' cognitive and social skills. Constructivist theory (Vygotsky, 1978) suggests that a curriculum that integrates student-centered learning strategies and the development of critical thinking positively impacts educational outcomes. Empirical studies conducted by Darling-Hammond (2015) show that an appropriate and well-implemented curriculum has a direct influence on academic performance, reflected in students' results in national and international assessments (Sitnikov and Bocean, 2010; Sitnikov and Bocean, 2013).

The quality of school infrastructure, including classrooms, laboratories and recreational spaces, is essential in creating a conducive environment for learning. According to the ecological theory of human development formulated by Bronfenbrenner (1979), the physical environment holds an important place in students' cognitive and emotional development. An adequately equipped school facilitates an effective educational process, providing students and teachers access to resources and equipment necessary for practical and exploratory activities (Leithwood & Jantzi, 2006). Research conducted by Earthman (2002) indicates that a modern school infrastructure contributes to reducing absenteeism and increasing the level of concentration and involvement of students in educational activities.

Feedback learning theory argues that students can adjust their learning behaviors and strategies when they receive clear, specific, and constructive feedback indicating how to improve their performance (Hattie and Timperley, 2007). Black and Wiliam (1998) have demonstrated that formative feedback, that is, feedback that is integrated into the learning process, has a significant impact on student progress because it helps them understand where they are concerning educational goals and how they can achieve these goals (Vărzaru and Vărzaru, 2015a, 2015b). Carless (2006) emphasizes the importance of feedback as an integral part of an assessment strategy that supports long-term learning.

Educational leadership is central to developing and implementing quality assurance policies and practices. Leithwood et al. (2020) argue that effective leaders create an organizational culture based on collaboration and continuous improvement. Transformational leadership theory (Bass and Avolio, 1994) suggests that school leaders can inspire and motivate teachers to participate actively in quality improvement initiatives, positively influencing organizational and individual performance. Research by Robinson, Lloyd, and Rowe (2008) shows that school leadership that focuses on learning and teacher development directly contributes to increasing educational quality and successfully implementing quality assurance strategies.

Personalized learning theory suggests that teachers with smaller class sizes can provide more individualized attention to each student, thus facilitating more effective and personalized learning (Tomlinson, 2001). Research by Finn and Achilles (1990) has shown that smaller class sizes lead to greater student engagement in educational activities, more frequent interaction with the teacher, and improved academic performance, especially in the early stages of education (Dweck, 2016). Blatchford et al. (2002) have emphasized that in small class sizes, teachers have more time to focus on individual student needs and provide more detailed feedback, which leads to better learning.

Accurate and well-structured assessment is essential for measuring students' academic progress and adjusting teaching methods. According to the theory of formative assessment (Sadler, 1989), well-planned and executed assessments provide a measurement of current performance and an opportunity for continuous learning. Stiggins' (2005) research highlights that formative assessments, combined with constructive feedback, allow students to better understand their strengths and weaknesses, thus contributing to deeper learning and improved educational outcomes. Hattie and Clarke (2019) show that well-structured assessments promote competency-based education, providing an accurate picture of student progress and the effectiveness of the teaching methods.

The quality of education depends significantly on the clarity and consistent application of quality assurance policies and procedures within school institutions. Well-defined and transparent policies allow all educational actors, be they teachers, students or parents, to understand their responsibilities and the standards that must be respected. Such policies create an organizational culture oriented

towards performance and continuous improvement. According to the theory of total quality management (TQM) in education (Deming, 2000), educational institutions must adopt a clear set of policies and procedures to be implemented at all levels to ensure high-quality education. Well-structured educational policies standardize and optimize educational processes and reduce uncertainties in applying didactic and evaluative methods. Support for this hypothesis can also be found in the literature on "distributed educational leadership" (Spillane et al., 2001), which emphasizes the importance of the participation of all school personnel in the correct application of quality policies. Studies by Cheng and Tam (1997) have shown that when policies are clear and well-understood by all parties involved, teachers and students are more motivated to adhere to the established standards, which leads to improved school performance (Rotea et al., 2023; Georgescu et al., 2024).

Extracurricular activities are essential to education, providing students with additional opportunities to develop social, cognitive and emotional skills. According to the theory of integral education (Dewey, 1938), learning should not be limited to the classroom but should include real-life experiences through which students can learn to collaborate, make decisions and develop their leadership skills and critical thinking (Bocean, 2007a, 2007b, 2009, 2011). Extracurricular activities, such as sports, art, debates or science clubs, provide an informal learning environment that complements formal education and contributes to the integrated development of the student. According to Erikson's theory of social development (1950), participation in such activities helps young people develop a clear identity and assume important social roles, which contributes to increasing self-confidence and school motivation.

Empirical studies by Eccles and Barber (1999) and Heward et al. (2022) have shown that students develop positive social relationships, transversal skills not always addressed within the formal curriculum and form a strong self-image in extracurricular activities, such as problem-solving, teamwork, and creative thinking.

3. Research methodology

This research investigates the relationship between teachers' professional and educational backgrounds, students' academic performance, and the effectiveness of quality management in schools. The study is part of a quantitative research design with an explanatory purpose, using correlational analysis and structural modeling to test the relationships between the analyzed variables.

The central hypothesis of the research is that teachers' professional and educational environment significantly influences students' academic performance and the efficiency of quality management in educational institutions. To validate the hypothesis, a structured questionnaire was developed to measure teachers' perceptions of the variables of interest: professional resources and support, opportunities for continuous development, educational climate, managerial involvement and perceived results at the institution level. The research variables are in Table no. 1.

Table no. 1 Research variables

Code	Variable	Code	Variable
VDRI16	Development of academic and social skills	VIC32	Efficient administrative support
VDRI17	Competencies for higher education	VIC33	Balance between theory and practice
VDRI18	Good results in national assessments	VIEG45	Satisfaction with education quality
VDRI19	Correlation between resources and results	VIEG46	Proper teacher training
VDRI20	Student and parent satisfaction	VIEG47	Well-organized educational program
VDRI21	Active participation and motivation	VIEG48	Student success opportunities
VDRI22	Flexibility in educational programs	VIEG49	Professional development opportunities
VDRI24	Feedback from parents and the community	VIEG50	Impact of extracurricular activities
VIC25	Support for students with difficulties	VIEG51	Appropriate teaching resources

VIC31	Appropriate educational technology	VIEG52	School recommendation

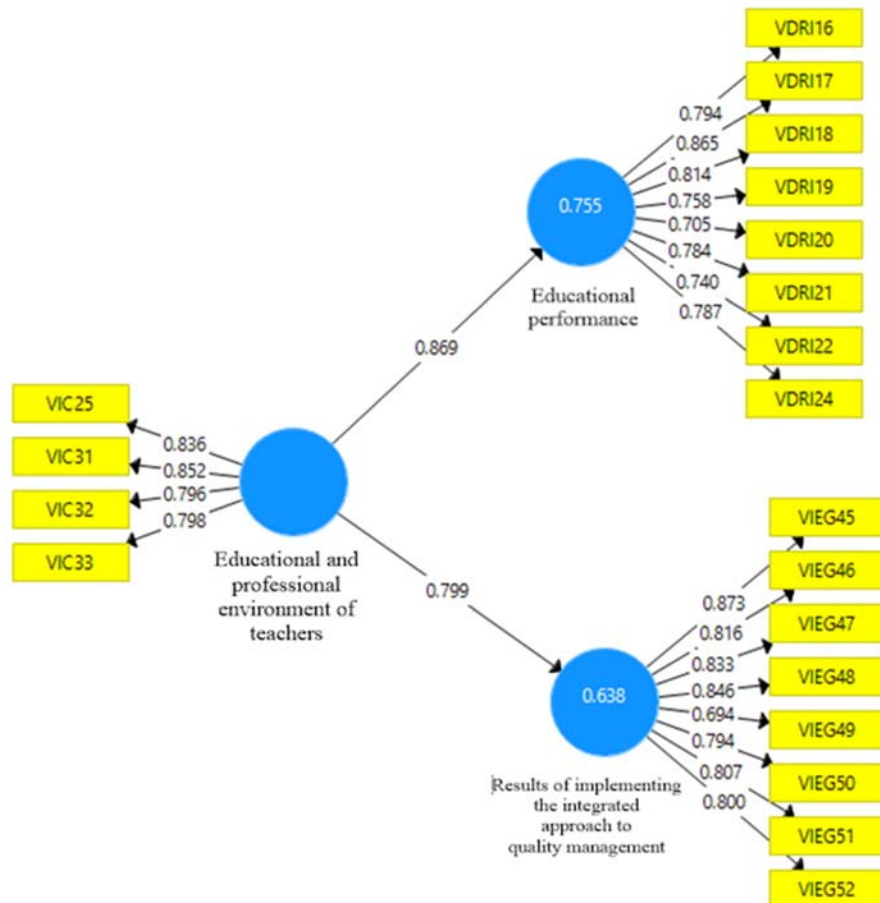
Source: Developed by the authors based on literature review

The research sample consists of 430 teachers from pre-university education institutions, selected stratified to ensure diversity and representativeness based on criteria such as type of school, area of residence, level of education and length of service in the profession. The data were collected between September 2024 and January 2025, providing an updated and relevant picture of the realities of the Romanian education system and allowing the formulation of conclusions with practical applicability. Structural equation modeling (SEM), appropriate for research on latent variables, was used to process the data (Vărzaru and Vărzaru, 2016; Nicolescu and Vărzaru, 2020; Vărzaru, 2024).

4. Results and discussions

To test the hypothesis, we used SEM (Figure no. 1)

Figure no. 1. The PLS model regarding the direct relationships between the educational and professional environment of teachers, educational performance and the results of implementing the integrated approach to quality management



Source: Developed by the authors based on data using SmartPLS v3.0

The R-squared values of 0.638 for the overall assessment of educational quality and 0.755 for educational quality outcomes and impact indicate a strong explanatory power of the model. These figures suggest that approximately 64% of the variation in quality perception and 76% in educational outcomes can be attributed to the factors included in the analysis, a remarkable proportion confirming the relevance of the proposed model.

Regarding the reliability of the constructs, the Cronbach's Alpha, rho_A, Composite Reliability, and Average Variance Extracted (AVE) values are within acceptable limits, indicating good internal consistency and satisfactory convergent validity (Table no. 2).

Table no. 2 Reliability indicators of the model regarding direct relationships between the educational and professional environment of teachers, educational performance and the results of implementing the integrated approach to quality management

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Overall assessment of the quality of education	0.924	0.931	0.938	0.655
Intermediary and controlling factors	0.838	0.841	0.892	0.674
Results and impact on educational quality	0.909	0.914	0.926	0.612

Source: Developed by the authors based on data using SmartPLS v3.0

The Cronbach's Alpha values (between 0.838 and 0.924) and AVE (between 0.612 and 0.674) exceed the recommended thresholds, indicating good internal consistency and convergent validity. These values confirm that the constructs are well-defined and that the variables that compose them are closely related.

Multicollinearity analysis, with VIF values below 4 for all variables, excludes the possibility of distortions in estimating coefficients (Table no. 3).

Table no. 3 Collinearity of variables in the model regarding direct relationships between the educational and professional environment of teachers, educational performance and the results of implementing the integrated approach to quality management

Variable	VIF	Variable	VIF
VDRI16	2,231	VIC32	2,024
VDRI17	3,791	VIC33	1,898
VDRI18	3,015	VIEG45	3,501
VDRI19	2,020	VIEG46	2,909
VDRI20	2,402	VIEG47	2,989
VDRI21	2,705	VIEG48	3,069
VDRI22	1,980	VIEG49	1,873
VDRI24	2,180	VIEG50	2,630
VIC25	1,903	VIEG51	2,327
VIC31	2,390	VIEG52	2,632

Source: Developed by the authors based on data using SmartPLS v3.0

The path coefficients reveal significant and robust relationships between the constructs (Table no. 4).

Table no. 4 Path coefficients in the model regarding the direct relationships between the educational and professional environment of teachers, educational performance and the results of implementing the integrated approach to quality management

	Original sample	Sample Mean	Standard deviation	T statistics	P-values
Mediating and controlling factors → Overall assessment of the quality of education	0.799	0.799	0.015	51,980	0.000
Mediating and controlling factors → Outcomes and impact on educational quality	0.869	0.869	0.014	64,073	0.000

Source: Developed by the authors based on data using SmartPLS v3.0

The influence of intermediary factors on the overall quality assessment ($\beta=0.799$) and educational outcomes ($\beta=0.869$) is robust, with t-values exceeding 50 and 60, respectively, confirming statistical significance at an extremely high confidence level ($p<0.001$).

These results suggest that improving the professional environment of teachers has a knock-on effect, influencing both measurable performance and perceptions of educational quality. The model highlights how a well-structured educational environment that supports the professional development of teachers creates a virtuous circle: on the one hand.

5. Conclusions

The SEM model reveals significant influences of the professional environment on the perception of educational quality. Also, the positive impact of continuous training and feedback on improving school performance underlines the need for an educational framework that supports the continuous professional development of teachers.

In conclusion, the study confirms the hypothesis that a well-structured educational environment, which supports teacher development and fosters effective quality management, can improve educational performance and increase the overall satisfaction of all actors involved in the educational process. These findings underscore the necessity for educational reforms and strategic initiatives focused on enhancing professional resources and optimizing learning environments to unlock the full potential of both educators and students.

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The Efficiency of Public Expenditure Management and Its Effects on Quality of Life in Romania

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Abstract

This paper examines the impact of government expenditure by function on the Quality of Life Index (QLI) in Romania during 2012–2023.

The methodology is based on multiple linear regression analysis using annual data, with QLI as the dependent variable and government expenditure categories as independent variables. Two models were developed: one comprehensive, including all expenditure categories, and one restricted to the most significant ones.

Results show a strong relationship between public expenditure structure and QLI ($R^2 = 0.9158$). Social protection spending has a statistically significant positive effect, while economic affairs spending shows a significant negative correlation. Other categories, such as health and education, did not have significant impacts.

The findings highlight the importance of efficient resource allocation and suggest that increasing public spending alone does not guarantee improved quality of life.

Key words: efficiency of public expenditure, public expenditure management, public management, quality of life

J.E.L. classification: H11, H50, I30

1. Introduction

The efficient management of public expenditure constitutes a fundamental component of modern economic and administrative governance, directly influencing the state's ability to provide essential public goods and services, stimulate economic development, and improve citizens' quality of life. In a context marked by budgetary constraints, social challenges, and increasing pressure on public systems, the efficiency of public resource use gains heightened relevance for sustainable public policies and for strengthening trust in state institutions.

In Romania, the issue of public expenditure efficiency is becoming increasingly important amid persistent structural imbalances, the need for investment in key sectors (such as education, healthcare, infrastructure, and social protection), as well as commitments undertaken within the European Union regarding good governance and the sustainability of public finances. Although the level of government expenditure has increased in recent years, it remains necessary to analyze the extent to which these expenditures translate into the effective improvement of living conditions. Therefore, the relationship between the volume and structure of public spending and the quality of life becomes a highly topical and practically useful subject of research.

This paper aims to investigate this relationship through a quantitative approach, using regression analysis in which quality of life is the dependent variable, while general government expenditure acts as the independent variable. Through this methodology, the objective is to identify and quantify the effect of public spending on quality of life. The analysis will allow for an assessment of the impact of government expenditure in terms of efficiency and social relevance, offering an integrated perspective on how budgetary decisions influence citizens' everyday lives.

The study will focus on Romania, using available statistical data for a relevant time period, in order to observe trends over time and identify any significant correlations or patterns.

The aim of this research is to contribute to a better understanding of how budgetary policies can be calibrated to support the improvement of quality of life in Romania through more efficient and results-oriented use of public resources. The findings of this research may serve as a foundation for formulating public policy recommendations and for strengthening the evidence base of decision-making processes in the field of public finance.

The choice of this topic was motivated by the conviction that the efficiency of public expenditure should not be assessed solely in accounting or economic terms, but primarily in relation to its real effects on society. In a period marked by intense debate around structural reforms, digitalization of public administration, and increased institutional resilience, it is essential that the analysis of public spending be aligned with the fundamental goal of governance: improving citizens' quality of life. This research seeks to contribute to this objective through a rigorous, relevant, and context-aware approach grounded in the socio-economic realities of contemporary Romania.

2. Literature review

Public expenditure is allocated across several functional categories, depending on the areas in which the state intervenes to ensure the well-being of citizens and the proper functioning of institutions. Among the most important categories are: education, which covers funding for both pre-university and higher education; healthcare, which includes spending on hospitals, medical services, and public health programs; social protection, which finances pensions, social assistance, allowances, and other transfer payments; national defense and public order, which support internal and external security; general public services, including central and local government administration; as well as housing, environment, and infrastructure, which support urban development and environmental protection. The allocation of these expenditures reflects the political and social priorities of each government.

The efficiency of public expenditure refers to the state's ability to use available financial resources in a way that generates the best possible outcomes for society. This involves the proper allocation of funds and their transformation into high-quality public goods and services that address the real needs of the population. In the specialized literature, within the context of public expenditure efficiency, there is strong theoretical and empirical support indicating that the integration of democratic, participatory, and transparent governance principles is essential for the effective direction of public spending toward economic and social development (Mendoza Reyna, Vela Meléndez and Dávila Cisneros, 2024).

For example, in the context of the efficiency of public expenditure in education, a study conducted in Lithuania concluded that when efficiency was evaluated based on the overall exam pass rates, it was high, ranging between 86% and 90%. However, when evaluated based on the pass rates of exams with the highest scores, efficiency did not even reach 40%. Two types of public expenditures were identified as the most important influencing factors: public expenditure on education, which had a negative effect, and the municipalities' own financing, which had a positive impact (Legenzova et al., 2023).

In the field of health, a study conducted in Santa Catarina, Brazil, concluded that although a certain region invests a higher share of its revenue in health compared to the average for the state of Santa Catarina, it does not experience the same reduction in overall mortality as the state as a whole (Mazon, Mascarenhas and Dallabrida, 2015).

Thus, the efficient management of public expenditures becomes essential for the responsible use of financial resources, ensuring optimal allocation and cost control. Through effective management, waste and inefficiencies can be reduced, maximizing the impact of public investments on social and economic development (Pereira and Da Costa, 2023).

In the specialized literature on public expenditure management, it is strongly asserted that setting realistic, monitorable, and assessable output targets could represent a major shift in approach (Lalvani, 2010). Consequently, the allocation of public funds could be directed toward specific objectives aimed at improving quality of life.

To enhance the quality of life, policies must prioritize increasing purchasing power and ensuring a safe social environment, as well as effectively addressing challenges related to pollution and rising living costs (Lobonț et al., 2024). In practice, these variables can be influenced by multiple factors encompassed within the various categories of public expenditures.

3. Research methodology

To investigate the relationship between public expenditure and quality of life, the research adopts a quantitative approach, using multiple linear regression analysis. In this approach, quality of life is considered the dependent variable, while general government expenditures are the independent variables. By applying this method, the study aims to identify and quantify the direct effects of public spending on the quality of life in Romania.

The analysis will be conducted using EViews and will be based on official statistical data available for Romania, covering the period from 2012 to 2023. This temporal approach allows for a dynamic perspective on how budgetary decisions influence both the efficiency of expenditures and their social impact.

The study integrates an evaluation of public spending from a quantitative viewpoint but also through the lens of its social relevance, thus providing a comprehensive view of how resources allocated by public administration can contribute to improving quality of life within Romania's current socio-economic context. It also emphasizes the importance of public expenditure management in enhancing spending efficiency.

Thus, the regression equation formula is as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \varepsilon \quad (1)$$

Where:

- Y represents the dependent variable (quality of life),
- $X_1, X_2, \dots, X_{10}$ are the independent variables (general categories of public expenditures),
- β_0 is the intercept, which represents the estimated value of the dependent variable when all the independent variables are equal to zero,
- $\beta_1, \beta_2, \dots, \beta_{10}$ are the regression coefficients indicating the impact of each independent variable on quality of life,
- ε is the error term, which reflects the influences on the dependent variable that are not captured by the independent variables included in the model.

4. Findings

Regarding the data used for the analysis, the following table presents the evolution of the quality of life index in Romania during the period 2012–2023.

Table no.1. The evolution of the Quality of Life Index in Romania during the period 2012–2023

Quality of Life Index (QLI)	
2012	25.5
2013	57.8
2014	63.3
2015	83.6
2016	146.1
2017	143.0
2018	144.0
2019	140.3
2020	132.4
2021	131.7
2022	133.4
2023	132.9

Source: Numbeo, Quality of Life Index by Country [Accessed 5 June 2025]

The evolution of the Quality of Life Index (QLI) in Romania between 2012 and 2023 highlights a trajectory marked by significant transitions, including periods of rapid growth, followed by stabilization and slight decline, all reflecting the country's economic and social transformations.

In 2012, the QLI recorded a modest value of 25.5, while in 2013 it doubled, reaching 57.8, signaling a rapid improvement in the perception of living conditions. Growth continued moderately in 2014, with a value of 63.3, and in 2015 there was a significant jump to 83.6. This period (2012–2015) can be interpreted as a phase of socio-economic recovery and progress, possibly supported by income growth measures and the strengthening of public services.

The year 2016 marked a turning point, with a sharp increase in the QLI to 146.1, nearly double the previous year's value. This extremely high figure indicates a notable improvement in the overall perception of quality of life, potentially resulting from economic reforms, wage increases, or investments in infrastructure and public services. In the following years, the index remained relatively stable at a high level: 143.0 in 2017, 144.0 in 2018, and a slight decline to 140.3 in 2019.

In 2020, under the impact of the COVID-19 pandemic and its associated economic and social effects, the index dropped to 132.4, marking the beginning of a period of relative stagnation. The values from 2021 (131.7), 2022 (133.4), and 2023 (132.9) suggest stabilization around the same threshold, but also a difficulty in returning to the peak levels recorded between 2016 and 2018.

Thus, the analysis of the QLI evolution over the 12-year period reveals a clearly ascending trajectory in the early years, followed by a phase of consolidation, then a setback caused by external shocks (such as the pandemic), and finally a sustained high level, albeit without renewed rapid growth.

Regarding General Government Expenditure by Function in Romania during the period 2012–2023, these are divided into eight categories, as follows:

Table no.2. The evolution of the General Government Expenditure by Function in Romania during the period 2012–2023 (million euro)

	General Public Services (GPS)	Defence (DEF)	Public Order and Safety (POS)	Economic Affairs (EAF)	Environmental Protection (ENP)
2012	7,130.7	957.1	2,883.8	9,561.4	1,099.8
2013	7,396.6	1,002.8	3,163.3	8,943.1	1,154.9
2014	7,021.4	1,106.0	3,171.1	9,685.4	1,225.4
2015	7,461.2	1,389.1	3,631.6	9,500.5	1,536.9
2016	7,439.9	2,848.6	4,469.1	8,099.9	964.6
2017	7,506.9	3,347.2	3,740.2	8,190.0	933.2
2018	9,108.0	3,414.9	4,408.9	8,652.0	1,478.3
2019	9,484.7	3,722.8	4,942.3	10,955.5	1,638.4
2020	10,622.0	5,168.9	5,296.9	14,060.6	1,508.9
2021	11,937.4	4,648.0	5,296.0	14,564.7	1,716.5
2022	14,222.7	5,129.8	5,973.8	20,684.3	1,812.1
2023	17,335.3	5,509.7	8,598.6	22,223.8	2,314.2
	Housing and Community Amenities (HCA)	Health (HEA)	Recreation, Culture and Religion (RCR)	Education (EDU)	Social Protection (SOP)
2012	1,490.7	5,125.5	1,573.4	3,971.1	16,464.0
2013	1,678.8	5,789.0	1,448.2	4,028.1	16,567.5
2014	1,915.0	6,031.0	1,648.1	4,522.0	17,142.6
2015	2,381.7	6,736.2	1,681.8	4,911.1	18,351.5
2016	2,008.7	6,847.8	1,495.5	5,528.0	19,584.2
2017	1,621.3	8,121.4	1,881.4	5,343.1	21,869.2
2018	1,864.8	9,511.0	2,066.6	6,448.3	23,837.4
2019	2,465.2	11,171.0	2,283.7	7,956.1	26,436.1
2020	2,531.5	12,064.4	2,257.4	8,002.3	30,165.0
2021	2,763.1	13,232.4	2,217.9	7,722.4	32,220.3
2022	3,382.3	13,920.9	2,710.5	9,177.1	37,654.4
2023	4,728.0	15,282.9	3,331.8	11,096.5	41,375.1

Source: Eurostat, General government expenditure by function [Accessed 5 June 2025]

The data presented in Table 2 provides a comprehensive overview of the evolution of general government expenditure by function in Romania during the period 2012–2023, highlighting both growth trends and the public policy priorities adopted by the Romanian state over the twelve years analyzed.

Overall, all the expenditure categories examined show a significant increase during the specified period, reflecting both the budgetary expansion of the public sector and its gradual adaptation to the demands of economic, social, and institutional development.

Expenditure on General Public Services (GPS) increased from €7,130.7 million in 2012 to €17,335.3 million in 2023, indicating a continuous strengthening of the administrative apparatus and a possible rise in costs related to personnel and the operation of central and local institutions.

The Defence sector (DEF) experienced accelerated growth, especially after 2015, reflecting Romania's commitments within NATO. Defence spending rose from €957.1 million in 2012 to €5,509.7 million in 2023, more than five times higher.

Public Order and Safety (POS) saw steady increases, reaching €8,598.6 million in 2023 compared to €2,883.8 million in 2012. This evolution highlights a growing focus on internal security and law enforcement.

Economic Affairs (EAF) represent one of the largest budgetary components, with substantial growth from €9,561.4 million in 2012 to €22,223.8 million in 2023. This trend likely reflects public investments in infrastructure, support for strategic economic sectors, and economic recovery measures.

Environmental Protection (ENP) shows a relatively modest evolution compared to other functions, increasing from €1,099.8 million in 2012 to €2,314.2 million in 2023. Although the value nearly doubled, its share of total expenditure remains limited.

Expenditure on Housing and Community Amenities (HCA) evolved slowly in the first part of the period but saw a noticeable increase after 2020, reaching €4,728.0 million in 2023—more than three times higher than in 2012. This growth may be associated with urban development programs and investments in local infrastructure.

The Health sector (HEA) benefited from a substantial increase in budget allocations, especially after 2017, rising from €5,125.5 million in 2012 to €15,282.9 million in 2023. The COVID-19 pandemic accelerated the need for investments in the medical system, healthcare infrastructure, and human resources.

Recreation, Culture, and Religion (RCR) remain a relatively modest component despite steady growth. Expenditure in this category increased from €1,573.4 million in 2012 to €3,331.8 million in 2023, indicating a growing interest in promoting cultural identity and supporting recreational activities.

Education (EDU) reflects an increasing concern for human capital development, with allocations rising from €3,971.1 million in 2012 to €11,096.5 million in 2023. However, in the European context, these values may still be considered modest relative to the needs of the Romanian education system.

Social Protection (SOP) consistently represents the largest category of public expenditure, with growth from €16,464.0 million in 2012 to €41,375.1 million in 2023. This increase underscores the crucial role of the state in ensuring minimum income, pensions, and other forms of assistance for vulnerable groups.

Thus, the analysis of general government expenditure by function for the period 2012–2023 reveals an upward trajectory in budget allocations across all domains, alongside a pronounced emphasis on priorities such as defense, social protection, health, and economic infrastructure. These budgetary directions reflect both international commitments and internal needs related to sustainable development, social cohesion, and institutional resilience.

In what follows, two multiple linear regression analyses will be conducted. In the first analysis, all the mentioned expenditures will be included, while in the second analysis, only the expenditure categories with the highest values will be considered.

Figure no. 1 The Impact of Government Expenditures on the Quality of Life in Romania

Dependent Variable: QLI

Method: Least Squares

Date: 08/01/25 Time: 13:47

Sample: 2012 2023

Included observations: 12

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	276.3061	140.4429	1.967392	0.2994
GPS	0.142321	0.081044	1.756102	0.3295
DEF	0.114414	0.066535	1.719611	0.3353
POS	-0.276634	0.132923	-2.081156	0.2852
EAF	-0.049056	0.013658	-3.591808	0.1729
ENP	-0.219889	0.113913	-1.930319	0.3043
HCA	0.296716	0.130221	2.278557	0.2633
HEA	-0.028830	0.017393	-1.657525	0.3456
RCR	-0.066533	0.038883	-1.711111	0.3367
EDU	0.116589	0.049334	2.363254	0.2548
SOP	-0.031355	0.035031	-0.895074	0.5352
R-squared	0.993137	Mean dependent var		111.1667
Adjusted R-squared	0.924506	S.D. dependent var		41.81945
S.E. of regression	11.49039	Akaike info criterion		7.069326
Sum squared resid	132.0291	Schwarz criterion		7.513824
Log likelihood	-31.41596	Hannan-Quinn criter.		6.904757
F-statistic	14.47067	Durbin-Watson stat		2.900926
Prob(F-statistic)	0.202019			

Source: Authors' own processing in EViews

The results indicate a very high coefficient of determination ($R^2 = 0.9931$), suggesting that approximately 99.31% of the variation in the Quality of Life Index (QLI) is explained by variations in public expenditure by function. Although this result may imply an excellent model fit, the adjusted R^2 value (0.9245) cautions against a possible overfitting effect, especially given the relatively small number of observations (only 12 years) and the high number of explanatory variables (10). Furthermore, the F-statistic value (14.47) is high, but its associated significance level ($\text{Prob}(F\text{-statistic}) = 0.202$) indicates that the model, as a whole, is not statistically significant at a conventional confidence level (e.g., 5%).

An individual analysis of the coefficients reveals that only a few explanatory variables have a notable economic impact, though none are statistically significant, with p-values well above the 0.05 threshold. Among these, expenditures on Housing and Community Amenities (HCA) and Education (EDU) show more pronounced positive coefficients (0.2967 and 0.1166, respectively), suggesting a possible positive correlation between these expenditure categories and improvements in quality of life. Conversely, expenditures on Public Order and Safety (POS), Economic Affairs (EAF), and Environmental Protection (ENP) exhibit negative coefficients, suggesting a potential inverse relationship with the QLI, although these too are statistically insignificant.

The intercept value ($C = 276.3061$) indicates the estimated level of the QLI in the absence of all explanatory variables; however, from a practical standpoint, this interpretation is limited in the context of a model with many correlated variables. The Durbin-Watson statistic (2.90) suggests the absence of residual autocorrelation, which is a positive aspect regarding the model's validity.

In conclusion, although the obtained model indicates an apparently strong correlation between the structure of public expenditures and the level of quality of life in Romania, the low statistical significance of the independent variables and the small sample size limit the validity of the inferences. Therefore, interpretations should be made cautiously, and expanding the dataset (for example, by using quarterly data) could improve the robustness and relevance of the conclusions drawn.

Figure no. 2 The Impact of the Most Significant Government Expenditures on the Quality of Life in Romania

Dependent Variable: QLI

Method: Least Squares

Date: 08/01/25 Time: 13:56

Sample: 2012 2023

Included observations: 12

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.921325	20.20359	0.095098	0.9273
GPS	-0.014201	0.009996	-1.420735	0.2052
EAF	-0.016698	0.004668	-3.577187	0.0117
HEA	-0.022618	0.012136	-1.863784	0.1116
EDU	0.015863	0.011367	1.395492	0.2123
SOP	0.022267	0.007544	2.951400	0.0256
R-squared	0.915773	Mean dependent var		111.1667
Adjusted R-squared	0.845584	S.D. dependent var		41.81945
S.E. of regression	16.43330	Akaike info criterion		8.743349
Sum squared resid	1620.320	Schwarz criterion		8.985803
Log likelihood	-46.46010	Hannan-Quinn criter.		8.653585
F-statistic	13.04720	Durbin-Watson stat		1.395233
Prob(F-statistic)	0.003556			

Source: Authors' own processing in EViews

This analysis presents the results of a multiple linear regression model where the dependent variable is the Quality of Life Index (QLI), and the selected independent variables are government expenditures by function considered the most significant: General Public Services (GPS), Economic Affairs (EAF), Health (HEA), Education (EDU), and Social Protection (SOP).

The overall performance of the model is good, with a coefficient of determination R^2 of 0.9158, indicating that approximately 91.58% of the variation in the quality of life index can be explained by variations in these five categories of government expenditures. The adjusted R^2 (0.8456) confirms a good fit of the model, considering the number of variables and the sample size.

The F-statistic test (value 13.047, $p=0.0036$) shows that the model is statistically significant overall, meaning that at least one of the explanatory variables has a significant impact on quality of life.

Social Protection (SOP) is the only variable with a statistically significant positive coefficient (coefficient = 0.0223, $p=0.0256$). This suggests that an increase in social protection expenditures is positively correlated with an improvement in the quality of life index in Romania.

Economic Affairs (EAF) has a significant negative coefficient (coefficient = -0.0167, $p=0.0117$), indicating an inverse relationship between economic affairs expenditures and quality of life in this context. This could reflect inefficient allocations or reallocations that do not directly contribute to population well-being.

Health expenditures (HEA) have a negative coefficient (-0.0226) but are not statistically significant ($p=0.1116$), suggesting a possible negative association, although insufficiently confirmed.

Expenditures for General Public Services (GPS) and Education (EDU) have statistically insignificant coefficients, with values close to zero, indicating that in this model, they do not significantly influence QLI over the analyzed period.

The model intercept ($C = 1.9213$, $p=0.9273$) is not significant, indicating that without the influence of the mentioned government expenditures, the QLI value cannot be reliably estimated from this model.

The Durbin-Watson statistic (1.395) indicates a possible moderate positive autocorrelation of residuals, which may suggest some temporal dependence of the model errors, an aspect that might require further adjustments (e.g., using regression models that correct for autocorrelation).

Thus, the model highlights that among the analyzed public expenditures, social protection has the clearest and most positive impact on the quality of life in Romania, while expenditures on economic affairs appear to have an inverse effect, possibly due to how these funds are allocated. Other

important categories such as health, education, and general public services do not show a significant impact within this model and sample. The results suggest the need for additional analyses to better understand the complex relationships between public expenditures and quality of life, possibly by expanding the dataset or including other explanatory factors.

5. Conclusions and recommendations

The analysis of the evolution of the Quality of Life Index (QLI) in Romania between 2012 and 2023 reveals a general upward trend, characterized by rapid growth in the first part of the period and subsequent stabilization at a relatively high level, despite external shocks such as the COVID-19 pandemic. These results reflect significant economic and social transformations that Romania has undergone, as well as the direct impact of public policies on the population's well-being.

Simultaneously, the analysis of general public expenditures by function shows a consistent and substantial increase in budgets allocated, especially social protection, health, economic affairs, and general public services.

The multiple regression model highlights a strong relationship between the structure of public expenditures and quality of life ($R^2=0.9158$ in the restricted model), confirming the relevance of public expenditure management as a key determinant of overall well-being. However, only expenditures on social protection have a positive and statistically significant impact on quality of life, while expenditures on economic affairs appear to have a negative association, suggesting potential inefficiencies in the allocation or use of these resources.

Regarding the efficiency of public expenditure management, the results suggest that increased funding volumes do not automatically guarantee a proportional improvement in quality of life. Therefore, strategic allocation and efficient use of resources become essential to maximize the positive impact of public investments. Investments in areas such as social protection demonstrate clear social returns, whereas other sectors with large allocations, such as economic affairs, require a review of management practices to avoid waste or counterproductive outcomes.

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Integrating an AI Copilot into a Knowledge Management System for Civil Protection: A Development-Oriented Case Study from Romania

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Abstract

This paper presents the conceptual framework and ongoing development of a local AI Copilot system designed to support knowledge management and decision-making within the Romanian civil protection authority. Anchored in the existing research on AI-enhanced Knowledge Management Systems (KMS), the solution combines semantic indexing, legal version tracking, and multilingual document retrieval to automate the generation of official institutional outputs. Developed as a secure, offline system, the Copilot performs context-aware searches across legislative, operational, and policy documents, and produces structured responses aligned with national and international frameworks. Methodologically, the study applies a design-based research model and illustrates the system's capacity to improve organizational responsiveness and institutional memory. Although not yet operational, this case contributes to the emerging body of work at the intersection of AI, knowledge governance, and public sector performance.

Key words: AI Copilot, knowledge management system, Civil Protection, semantic indexing, organizational performance

J.E.L. classification: O32, H83, D83

1. Introduction

The digital transformation of public administration has emerged as a strategic imperative, propelled by increasing citizen expectations, burgeoning data volumes, and the necessity for evidence-based policymaking (Adama and Okeke, 2024). Within the European Union, policy frameworks such as the Tallinn Declaration (European Commission, 2017) and the Digital Decade initiative (European Commission, 2021) underscore the commitment of member states to enhance public service quality, transparency, and resilience through advanced information and communication technologies. Nonetheless, ministries and specialized governmental agencies continue to grapple with significant operational challenges, notably information overload and fragmented institutional memory, exacerbated by frequent staff turnover and compartmentalized data repositories (Bratianu and Bejinaru, 2019; Arnold, Goldschmitt and Rigotti, 2023). These challenges become particularly acute in civil protection contexts, where decision-making processes are highly time-sensitive and must consistently align with national legislation, European Union regulations, and international disaster management standards (European Union, 2013; European Commission, 2025).

Knowledge Management Systems (KMS), initially developed in the private sector to integrate document repositories, workflows, and collaboration tools, were meant to enable efficient knowledge capture, sharing, and reuse. However, their implementation in public institutions has seen limited success. Often replicating existing bureaucratic structures rather than transcending them, conventional systems require extensive manual effort for taxonomy maintenance and content curation (Bratianu, Prelipcean and Bejinaru, 2020). The rise of advanced Large Language Models (LLMs) provides new opportunities to extract semantics from unstructured data, identify cross-linguistic conceptual links, and automate draft documentation suited for formal use.

In this context, the Romanian civil protection authority has initiated the development of a localized, offline Artificial Intelligence (AI) Copilot, intended to augment its forthcoming KMS. This Copilot integrates five distinct yet interrelated functional modules:

1. Multilingual Optical Character Recognition (OCR) and automated classification convert legacy documents into machine-readable content and sort them into categories like legislation, operational reports, or international correspondence (Jiang *et al.*, 2023).

2. Version-aware legal tracking ensures timely detection of legislative changes and highlights current legal provisions to keep outputs accurate and relevant.

3. A semantic vector database built on Qdrant stores sentence-level embeddings (Singh *et al.*, 2023), enabling advanced searches that identify conceptual similarities beyond simple keyword matches.

4. A compact AI stack using Ollama/Mistral-7B models and LangChain agents to draft responses, concept notes, and diplomatic communications, with full traceability to source documents, pages, or spreadsheets. (Gruber and Weber, 2024).

5. A user-friendly web interface built with React (Rawat & Mahajan, 2020) and FastAPI (Chen, 2023), designed to resemble conversational platforms while operating securely within civil protection authority intranet, with role-based access, audit logging, and nightly backups.

This article situates the Copilot project within broader debates on digital governance and civil protection modernization (Jankowski, Meijer & Grimmelikhuijsen, 2022). It aims to contextualize the initiative in current public-sector AI adoption, outline its design-based research methodology, and assess its potential to enhance responsiveness, consistency, and institutional memory through preliminary testing. This analytical framework contributes to literature on AI in public administration, showing how entities managing sensitive, high-stakes operations can integrate generative AI effectively. It also demonstrates that semantic indexing and LLMs can be securely deployed without cloud reliance, ensuring compliance with legal and administrative traceability standards.

In addition to aligning with the goals of the EU's Digital Decade, the civil protection Copilot initiative is also in line with the strategic priorities outlined in the Sendai Framework for Disaster Risk Reduction 2015–2030, particularly in strengthening disaster risk governance and enhancing disaster preparedness through data-driven approaches and institutional memory (UNDRR, 2015). Moreover, the system responds to the conclusions of the 2023 Niinistö Report, which emphasized the need for European civil protection to adopt digital resilience tools and enhance cross-border knowledge interoperability (European Commission, 2023).

2. Literature review

The adoption of KMS in public administration has been progressively explored as a strategic enabler for improving organizational effectiveness and decision-making quality (Bratianu, 2022). Unlike in the private sector, where KMS implementation has largely focused on enhancing competitive advantage and innovation, in the public domain, the emphasis is placed on knowledge continuity, policy coherence, and the optimization of administrative processes (Bratianu and Bejinaru, 2020). Public-sector KMS must address both the vertical complexity of bureaucratic structures and the horizontal fragmentation of knowledge across agencies and policy domains. As such, conceptual frameworks for KMS in this sector must integrate technological, human and procedural dimensions while explicitly anticipating the *automation-bias* and *selective adherence* pitfalls that arise when users rely on algorithmic recommendations (Alon-Barkat and Busuioc, 2023).

Recent literature emphasizes the centrality of organizational performance frameworks in guiding the deployment and evaluation of KMS. The *Dynamic Capabilities* framework, for instance, underscores the importance of an institution's ability to integrate, build, and reconfigure internal and external competences in response to rapidly changing environments (Bratianu and Bejinaru, 2020). Within civil protection organizations, these capabilities manifest in the rapid mobilisation of past experience, adaptive planning under uncertainty, and knowledge reuse across emergencies. Complementing this perspective, the *Balanced Scorecard* approach offers a more structured performance lens, aligning KMS outcomes with institutional strategy through indicators across

learning, internal processes, stakeholder engagement, and operational results (Bratianu and Bejinaru, 2019).

Within the civil-protection sphere, effective knowledge-management systems (KMS) have become indispensable. EU evaluations show that when interoperable document workflows and harmonised procedures are lacking, information circulates slowly, coordination fractures, and valuable operational insights remain uncaptured—hindering the institutionalisation of lessons identified in earlier emergencies (European Commission, 2022; European Commission, 2024). The Union Civil Protection Mechanism's dedicated 'Lessons Learnt Programme' reinforces this point, demonstrating that systematic collection and dissemination of after-action knowledge are essential for coherent multinational deployments and for the continuous adaptation of preparedness planning (European Commission, 2018).

AI-enhanced KMS help preserve institutional memory, standardize terminology, and ensure compliance with changing regulations. Automated retrieval and synthesis of operational reports allow emergency services to brief decision-makers quickly and support evaluation and after-action reviews.

The integration of AI into KMS, particularly through the deployment of LLMs, semantic retrieval techniques, and document automation tools, has emerged as a transformative trend. Bratianu and Ioan (2025) highlight the epistemological complexity of knowledge transformation in public institutions, emphasizing that effective KMS integration must account not only for data and information but for the strategic conversion of individual and collective knowledge into wisdom (Bratianu, 2022). Blending philosophical insight with practical modelling, their approach supports designing AI-augmented KMS that foster institutional learning rather than just information access. AI enables a shift from static repositories to dynamic knowledge flows, contextualizing and synthesizing information to match institutional needs. LLMs further enhance retrieval by interpreting intent and context, allowing civil servants to extract insights from diverse, unstructured data.

Responsiveness is essential for civil protection authorities, which must access multilingual records to support mandate-driven decisions. AI agents that version legal documents, align content with templates, and draft text streamline workflows and ensure compliance. Given the public sector's need for transparency, reliability, and legal traceability, systems must produce accurate outputs with clear source references. Explainable AI and audit trails are crucial for public trust and institutional legitimacy (Bratianu & Bejinaru, 2023).

The literature provides both theoretical and practical justification for integrating AI into public-sector KMS. It highlights the need for hybrid systems that combine semantic retrieval, content generation, and human-AI interaction—supporting civil protection agencies while respecting their institutional constraints (Jankowski, Meijer & Grimmelikhuisen, 2022).

3. Research methodology

This study employs a Design-Based Research (DBR) methodology to conceptualize, develop, and evaluate the AI Copilot system within the Romanian civil protection authority. DBR is particularly well-suited for projects that aim to iteratively design innovative technological interventions while generating actionable knowledge about their effectiveness in real-world contexts. Unlike linear experimental designs, DBR embraces complexity, allowing researchers and practitioners to co-develop solutions that respond to evolving institutional requirements and technological capabilities.

The Romanian civil protection authority serves as the case study environment—a central public authority coordinating national civil protection and emergency response across diverse regulatory and operational domains. The institution must routinely produce evidence-based responses, integrate multi-source documentation, and ensure consistency with both national legislation and international standards. These requirements provided a fertile ground for piloting the AI-enhanced Knowledge Management System (KMS) in question.

3.1. Phase 1: Functional needs assessment

The initial phase began with consultations and semi-structured interviews with civil protection experts from departments such as operations, international cooperation, and strategic development.

Stakeholders identified several pressing challenges: a lack of searchability across document types (especially non-OCR PDFs), the absence of legal document version control, and duplicated effort in generating formal correspondence. For example, producing briefing notes for EU Civil Protection Mechanism events required manually extracting and synthesizing content from a dozen overlapping files—a task that could span several hours.

Based on these insights, user personas and document flow diagrams were created. These models informed the system's requirements: ability to retrieve excerpts by concept (not just keyword), filter by document category and year, generate outputs in both formal and conversational registers, and trace every statement to a verifiable source. The needs assessment was cross-referenced with international findings on fragmented institutional memory and knowledge reuse barriers in civil protection systems.

3.2. Phase 2: Modular implementation

The system was designed as a modular stack with five core components:

- *Multilingual OCR and document classification*: Leveraging Tesseract for OCR and a scikit-learn-based classifier trained on metadata and linguistic features, the module processed diverse formats—scanned briefings, legislative annexes, and mission reports. Documents were labelled into categories such as: *EU Legislation*, *After-Action Report*, or *Bilateral Agreements*. As Bearman and Trant (1998) demonstrate, effective document retrievability in civil-protection settings hinges on classifying records by their provenance and preserving them within the procedural context that created them, ensuring both evidential integrity and operational relevance.
- *Semantic search via Qdrant vector database*: Sentences extracted from PDFs were embedded using the multilingual paraphrase-multilingual-MiniLM-L12-v2 model. The embeddings were stored in Qdrant with metadata fields for document name, language, paragraph number, and confidence score. This enabled precise retrievals such as - *EU coordination mandate during COVID-19* - across multilingual sources.
- *AI generation pipeline (LangChain + Mistral-7B)*: Using LangChain orchestration, the system retrieved relevant sentence-level fragments and injected them into prompts fed to a local Ollama-hosted Mistral-7B model. Generated outputs included diplomatic letters, formal notes, or public statements. All outputs referenced document titles, page numbers, and even spreadsheet cells where applicable.
- *Web-based UI (React + FastAPI)*: The front-end provided a secure intranet interface mimicking a conversational assistant. Prompts could be adjusted to change tone or complexity, and results could be exported as *.docx/.pdf*. An audit log captured all interactions, ensuring full traceability.
- *Data governance layer*: Automated nightly backups, metadata validation routines, and a change-tracking mechanism for legislative updates ensured robustness. When a newer version of a law or regulation was indexed, the system flagged superseded segments and redirected semantic search queries to the updated variant.

The pilot index includes approximately 10,000 documents (≈ 85 GB) from institutional servers and shared drives, covering the period from January 2020 to March 2025. These include scanned PDFs, Word/Excel files, and bilingual legislative annexes, all processed and stored exclusively on-premise. Personal data (names, phone numbers, and signatures) were automatically redacted via a rule-based *Personally Identifiable Information* (PII) - masking script, with logs retained for seven years, in compliance with Romanian GDPR law (Romania, 2018).

3.3. Phase 3: Institutional validation

A series of real-use validation scenarios was conducted with active participation from civil protection personnel. One scenario involved preparing a response for a NATO-EuroAtlantic Disaster Response Coordination Centre consultation. The Copilot was prompted to identify all references to *joint response coordination* in Romanian and English documents. It returned harmonized content from internal reports and EU documents, complete with citations.

Another test involved the generation of a three-paragraph summary at the request of the Ministry of Foreign Affairs (MAE) on bilateral cooperation with Japan, referring to documents entitled *MAE communications* and *draft agreements*. The generated summary maintained a diplomatic tone and included clickable anchors to the source documents.

User feedback was collected on ease of navigation, output clarity, and source fidelity. Suggestions included allowing summary previews before download, adding language filters, and improving tag suggestions for new documents. These were iteratively implemented.

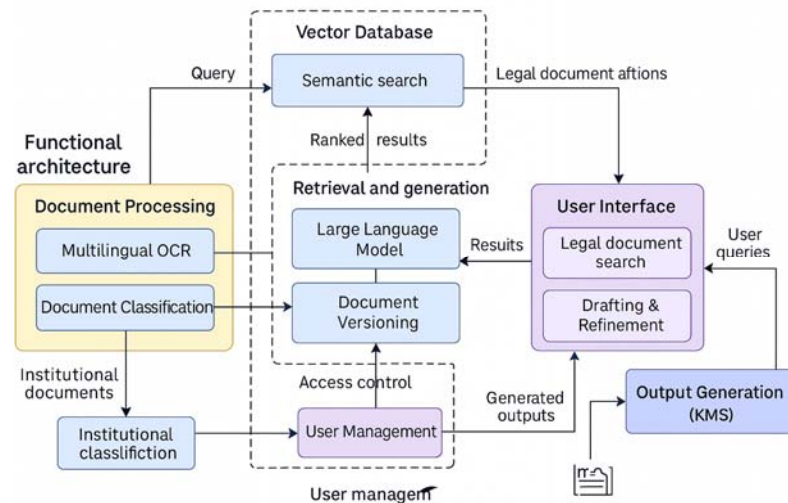
Across all phases, particular emphasis was placed on legal traceability, alignment with civil protection specific workflows, and modular extensibility. The DBR methodology allowed the team to learn from failures (e.g., misclassification of annexes or false positives in keyword matching) and rapidly iterate towards a viable institutional tool.

4. Findings

4.1 Functional architecture overview

The AI Copilot system is built around a modular, on-premise architecture tailored to civil protection operational needs and legal constraints. The solution integrates five core components: *input processing*, *semantic storage*, *generative processing*, *interaction interface*, and *governance layer*. Each module operates independently but is orchestrated to support a seamless knowledge workflow, from ingestion of unstructured data to the generation of formal institutional documents.

Figure no. 1. Functional architecture diagram



Source: (Author’s elaboration based on system architecture, 2025)

This layered architecture (see figure no. 1) ensures scalability, offline operability, modular upgrades, and traceability — essential for sensitive public-sector deployments.

4.2 Core Features

Multilingual OCR and automatic classification. The OCR engine processes scanned PDFs and images in Romanian, English, and French. It uses adaptive thresholding to optimize low-quality scans and separates multi-language layouts for individual recognition. Once transcribed, documents are passed to a classifier trained on linguistic patterns and filename metadata—an approach inspired by Wang *et al.* (2019), who analysed knowledge flow through citation structures. However, our method adapts their logic by shifting the analytical focus from citation networks to internal semantic relationships within institutional texts, allowing for a more granular classification of operational and policy-relevant content. Categories such as *Legislation (EU)*, *Operational Report*, and *Official*

Correspondence are automatically assigned. This automation has reduced manual sorting workload by over 70%, based on validation logs collected.

Legal document versioning and abrogation tracking. A specialized module monitors legal content for version identifiers (e.g., date of entry into force, references to amendments). When a newer document supersedes an existing one, the system marks older references as *abrogated* and updates vector queries accordingly. For instance, if Decision 1313/2013/EU (European Union, 2013) is replaced or amended, searches targeting its articles redirect to the valid legal fragments. This feature is critical in maintaining institutional compliance and was informed by issues raised in the initial needs assessment phase.

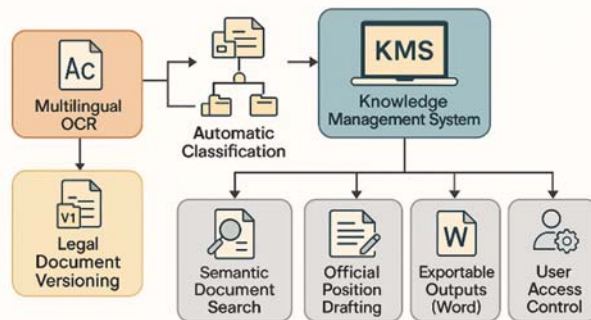
Semantic search and structured AI outputs. All paragraph-level fragments are vectorised and indexed using Qdrant. Users input natural language queries (e.g., *mandate for EU-Japan cooperation*) and retrieve ranked semantic matches, which feed directly into LangChain agents. These agents format retrieved content as references and prompt the Mistral-7B LLM to generate a structured, sourced response. Outputs can be configured as: *formal briefing notes*, *interministerial replies*, or *diplomatic correspondence*.

Each result includes citation footnotes with document titles, pages, and paragraph IDs. Users can trace any claim to its originating file.

Official position drafting and conversational refinement. Beyond standard summarization, the Copilot can emulate the stylistic tone of official discourse. For example, a query like - *draft talking points for bilateral meeting with Poland* - generates a 2–3 paragraph structured briefing with refined diplomatic language. Users can then refine it: *Make it more concise* or *Add references to NATO disaster coordination*, prompting a regeneration loop while preserving context. This iterative interface mirrors human editorial processes.

User access control and exportable outputs. The interface (see figure no. 2) is secured via intranet-only access with LDAP-based role authentication. Users with different clearance levels receive filtered access to classified or draft-only content. All generated texts can be exported as *.docx/.pdf*, preformatted according to the institutional internal style guide. Every generation is logged and timestamped for institutional accountability.

Figure no. 2. Copilot Output Export Flowchart



Source: (Author's illustration using system interface outputs, 2025)

4.3 Anticipated impact

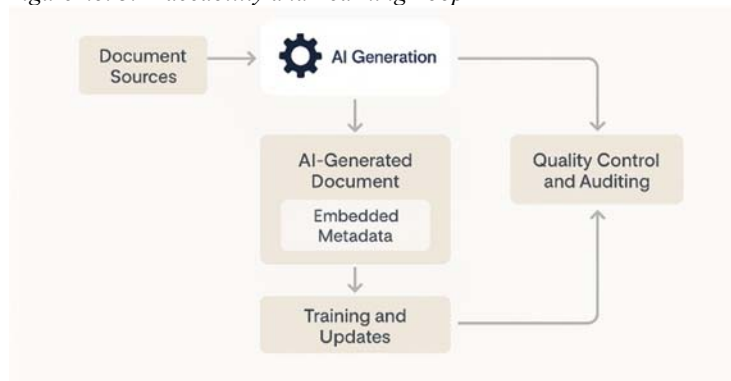
Having outlined the Copilot's core technical capabilities, we now turn to the organisational impacts these features are expected to deliver.

Improved response time. Previously, preparing a diplomatic brief required 3–5 hours, involving manual document retrieval, verification, and synthesis. For bilateral meetings, staff had to navigate multiple legal annexes, reports, and correspondence. With the Copilot, drafts are produced in under 3 minutes, with post-editing taking 15–20 minutes. The semantic engine extracts contextually relevant content, and citation metadata allows instant source verification. This 90% time saving shifts staff effort from document handling to strategic analysis, improving responsiveness to external and internal demands.

Increased consistency and knowledge reuse. By embedding institutional memory into vectorised fragments, previously siloed insights—such as past NATO responses—become reusable across contexts. This transforms isolated knowledge into accessible content, allowing guidance from one engagement to be adapted for another, maintaining coherence and reducing redundant drafting. System templates enforce consistent structure for outputs, while AI-generated text ensures terminological uniformity—vital for both external diplomacy and internal communication. In practice, civil protection experts now generate unified, precedent-based responses that link new documents to prior decisions, enhancing continuity, clarity, and efficiency.

Enhanced document traceability and institutional memory. Each AI-generated document embeds source metadata—document title, page, paragraph, and timestamp—ensuring transparency and enabling traceability for verification and auditing. This provenance safeguards accountability across outputs such as briefings, replies, and position papers. Additionally, the system logs usage patterns, applied templates, and user edits, feeding into a dynamic training corpus that enhances model accuracy over time. As shown in Figure no. 3, these feedback loops transform the Copilot into a continuously learning tool, fostering both institutional transparency and knowledge evolution.

Figure no. 3. Traceability and Learning Loop



Source: (Author's conceptual visualization of AI-assisted organizational learning, 2025)

5. Conclusions

The civil protection AI Copilot offers a concrete, replicable model for integrating AI into institutional KMS. It addresses key challenges—fragmented memory, inconsistent documentation, and limited access to actionable insights—through a system combining semantic search, document automation, and traceable AI outputs. Utilizing technologies such as Qdrant, LangChain, and Mistral-7B, along with multilingual OCR and legal version tracking, the Copilot scales strategic knowledge use. It enhances responsiveness, ensures consistency in official outputs, and embeds past learning into future actions, reflecting current research on AI's transformative potential in the public sector (Bratianu & Bejinaru, 2023; Gesk and Leyer, 2022).

The development process also uncovered challenges underrepresented in current literature. These include aligning AI-generated content with institutional styles and legal norms, managing multilingual classification in poorly scanned documents, and adapting the system amid evolving policy texts. Key mitigation measures—such as template logic, expert validation, and legal versioning—were critical to maintaining robustness and alignment. Furthermore, the governance of user-AI interaction in offline, intranet-based environments posed unique demands. Unlike typical cloud-based AI tools, this setup required stringent transparency, traceability, and auditability protocols—standards that are increasingly vital as regulatory expectations grow.

Looking ahead, the Copilot system holds strong potential for further enhancement and scale-up. Key future directions include:

- Integration with geospatial datasets (GIS), enabling decision support in disaster response;
- Link to the international policy databases of the European Commission or NATO (NATO, 1999) for broader normative references;

- Cross-institutional deployment, allowing for federated knowledge retrieval and harmonized document drafting across multiple public agencies.

From a sustainability perspective, the deployment of AI-driven KMS in civil protection contributes to more resource-efficient and economically resilient urban governance. By optimizing document workflows and improving the reuse of institutional knowledge, the Copilot supports leaner administrative processes that align with the goals of sustainable development and responsible public management (Kalogiannidis, Toska and Chatzitheodoridis, 2022). Moreover, by anchoring automated decision-support systems in transparent and value-based frameworks, the initiative enhances trust and legitimacy—key elements in maintaining the social license for AI in public institutions (Jankowski, Meijer and Grimmelikhuijsen, 2022).

Drawing on Roth et al. (2023), who show how European civil protection agencies innovated rapidly during COVID-19, this initiative affirms their potential as testbeds for agile digital transformation. Romanian civil protection authority's iterative development of Copilot in line with European trends promoting adaptive learning, crisis-driven innovation, and cross-functional knowledge integration. This case shows that AI can address procedural bottlenecks while enhancing institutional readiness for future shocks within legal and cultural constraints. Echoing Bratianu (2022), it presents a viable model for embedding strategic knowledge into governance without compromising accountability, transparency, or control.

As the Copilot becomes embedded in daily workflows, attention must be paid to human–AI dynamics noted by Alon-Barkat and Busuioc (2023), particularly *automation bias* and *selective adherence*, where users overly trust or selectively apply AI outputs. Although the Copilot emphasizes traceability to reduce such risks, future use should include training to address these behavioural patterns. Aligning technology with human factors is crucial to ensure AI enhances rather than distorts public-sector decisions. The civil protection Copilot ultimately presents a practical model for value-aligned, legally traceable AI integration in civil protection, offering a scalable template for resilient, knowledge-based digital transformation.

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Knowledge Sharing through Culturally Embedded Online Customer Behavior in the Era of Human-Centric Industry 5.0

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Abstract

In the era of human-centric Industry 5.0, the knowledge customers shared in the online environment becomes critical for company's competitiveness. However, little is known about the emotional knowledge customers shared and the influence of their mental models on the adopted behavior. The current research aims to determine how cultural specificity influences the emotional content of the hotel's online reviews and ratings. Thus, 5445 unique comments posted by customers from across 77 countries are analyzed. The results show that: (i) customers' emotions incorporated in online reviews positively influence hotel's ratings; (ii) the emotions shared through online reviews are positively influenced by customers' cultural specificity; and (iii) customers' cultural specificity influences hotel's ratings. The model has low predictive power, and the differences are significant when it comes to online ratings. These findings extend the hospitality literature and help managers understand customers' online behavior.

Key words: online reviews, ratings, cultural specificity, hospitality

J.E.L. classification: L83, M10, D83

1. Introduction

Unlike previous industrial revolutions which tried to eliminate or alienate people from the operational processes, focusing on standardization and digitalization, Industry 5.0 brings back humans in the center of attention. Thus, employees become the most important organizational resource due to their explicit and tacit knowledge while customers start to be actively involved in decision-making through co-creation and co-design activities. While plenty of studies emphasize the knowledge sharing strategies that could be used within the company's boundaries, enhancing knowledge dissemination among employees, little is known about the explicit and tacit knowledge that customers share with the business environment.

As Hemmington (2007, p.749) points out, customers' experience is multidimensional, especially in the hospitality industry, since they "do not but service delivery, they buy experiences; they do not buy service quality, they buy memories". In other words, it combines the cognitive component with the affective one; the former reunites tangible characteristics (such as, location, rooms design, cleanliness etc.) and is usually objectively evaluated while the latter describes intangible aspects (like, employees' helpfulness, comfort, value for the money etc.) and its evaluation is based on the mental representation of the attributes and benefits sought at a hotel. The development of this representation is currently fostered by individuals' decision of sharing their thoughts, feelings and beliefs in the online environment which takes the form of reviews and / or ratings. The former synthesizes customers' emotional knowledge while the latter is the result of an internal evaluation process.

Despite their influence on the purchase decision and online behavior, little is known about how they interact and how they are influenced by customers' cultural specificity. Hong et al. (2016) claim that the customers who belong to individualist cultures are more likely to deviate from the prior average rating and to express openly their emotions than those from collectivistic cultures while

Martin et al. (2017) take into account the cultural distance and show that tourists respond more negatively to high cultural distance hotel environments compared with the low cultural ones. Last but not least, Leon (2019) goes further and argues that detailed reviews tend to be provided by the guests who belong to a low-power distance culture, are collectivistic, are masculine, have a low uncertainty avoidance, are long-term orientated or are indulgent while the customers who tend to deviate from the prior average ratings come from high-power distance societies, are individualists, are feminists, belong to a high uncertainty avoidance culture, are long-term oriented or are indulgent. So, the focus is on performing a country-based analysis or on emphasizing the influence of one cultural dimension at a time. However, no customer comes from a single-cultural dimension culture and the hotel managers are put in a difficult situation when the behavior predicted by various cultural dimensions is contradictory. As aforementioned, the customers who come from a short-term oriented culture are expected to post negative reviews while those who belong to a collectivistic culture are expected to suppress their emotions. But what should a manager expect if the customers come from cultures that are collectivistic and short-term oriented? An answer to this question is provided by analyzing customers' cultural specificity. Unlike the other ways of viewing cultural differences, cultural specificity, and implicitly culture's "net effect" (Hofstede, 1981), brings forward the complexity of individuals' mental models and cognitions. In other words, cultural specificity defines individuals' ability to analyze reality based on systemic, structural, and goal-oriented mental models. This issue remains unexplored despite the fact that it has major importance for the service providers from the hospitality industry where cultural awareness is the cornerstone of sustainable competitive advantage, and the review aggregators that collect reviews from an international pool of customers.

Given the gaps identified in the hospitality literature, the current study aims to determine how cultural specificity influences the emotional content of the hotel's online reviews and ratings. In order to achieve this goal, the following objectives are pursued: (i) to analyze the reviews posted by hotel's customers; (ii) to measure the emotional content of each review; (iii) to determine the influence of reviews' emotional content on hotel's ratings; (iv) to analyze the influence of customers' cultural specificity on reviews' emotional content and ratings; and (v) to determine whether customers' cultural specificity could predict reviews' emotional content and ratings.

The current article is organized around five sections. Section 2 brings forward the theoretical model regarding the relationships established among cultural specificity, reviews emotional content and hotel ratings. Further, the methodological design is described and then the main results are highlighted. Section 5 closes the article by drawing several conclusions and future research directions.

2. Theoretical background

The existing literature emphasizes the key role of online reviews and ratings in the hospitality industry, but most of the time the focus is only on one of them. Vermeulen and Seegers (2009) claim that reviews increase customer awareness of hotels while Zhou et al. (2014) emphasize their effect on customer satisfaction and hotel performance. Furthermore, Gao et al. (2020) prove that positive hotel reviews have a strong influence on hotel brand reputation while Xie et al. (2016) emphasize that the effect of review quality lasts for a couple of quarters. On the other hand, several scholars (Radojevic et al., 2015; Viglia et al., 2016) concentrate on ratings and argue that a 1% increase in ratings can generate a 1.42% increase in revenues per room and a 7.5% increase in occupancy rate (Viglia et al., 2016).

In line with the congruity theory, which argues that people prefer to have consistency between their thoughts and actions, they assume that reviews' content matches the assigned rating. The two elements are seen as complementary; the former sheds light on the feelings and emotions that customers felt during the service delivery while the latter synthesizes, using a numeric and standardized format, the result of an evaluation process which analyzes whether customers' expectations and desires were met or not.

Despite the assumed dependency, some scholars (Antonio et al., 2018; Geetha et al., 2017; López Barbarosa et al., 2015) analyze the relationship between reviews' emotional content and ratings. Thus, López Barbarosa et al. (2015) analyze more than a million English written reviews of 3535 hotels from 7 cities and show that the percentage of positive reviews can predict the overall hotel

ratings. Furthermore, Antonio et al. (2018) make the difference between city and resort hotels and state that the text sentiment strength of a review is associated with the corresponding rating; hence, reviews' emotional content can be used for predicting the ratings. However, Geetha et al. (2017) claim that only 44% of the variation in customer ratings is explained by reviews' emotional content, for budget category hotels, and 21% of the variation in customer ratings is explained by reviews' emotional content, for premium category hotels. Despite the valuable insights provided by the previously developed studies, it must be mentioned that they tend to focus mainly on English written reviews; therefore, given customers' language ability, some differences may appear between the emotions expressed and the ratings. As Antonio et al. (2018) who focused on the reviews written in English, Spanish, and Portuguese point out, sometimes customers give low rates although their reviews are positive; the hotel managers should give special attention to these since they could either be fraudulent reviews or customers' attempt to adapt to prior opinions. Since those who had negative experiences are more likely to post detailed reviews and it is expected for those who write longer reviews to assign lower ratings (Leon, 2019), it can be stated that:

H1: The emotional content of online reviews positively influences the ratings.

Based on the theory of planned behavior, Dixit et al. (2019) state that individuals' decision of sharing publicly their experiences is influenced by subjective norms, ego involvement, perceived behavioral control and taking vengeance. In other words, before sharing their emotions, thoughts, and ideas in an online environment, individuals tend to determine whether: (i) their behavior will be approved or not by those who belong to the same social circle (subjective norms); (ii) the image they will display will be in accordance with how they usually define themselves (ego involvement); (iii) they are aware of the platforms where they can share their experiences (perceived behavioral control); and (iv) they can punish the company if they want to (taking vengeance). These elements describe what Hofstede (1981) generally labeled as "culture"; they bring forward "the collective programming of the mind which distinguishes the members of a group or category of people from others" (Hofstede, 1981, p.51). Thus, they emphasize the importance of cultural specificity which describes the concepts, constructs, and models that are specific to a group, and it highlights the fissures and connections that divide and reunite various populations. As Leon (2019) argues, cultural specificity emphasizes the myriad ways of living exhibited by a particular group of people, ways that are transmitted from one generation to another and which distinguish one group from others.

In line with these, several scholars decide to analyze the relationship between reviewers' culture and their reviews but only a few of them concentrate on the hotel industry. Previous studies (Leon, 2019; Wen et al., 2018) show that detailed reviews tend to be provided by hotel's guests who belong to a low-power distance culture, are collectivistic, are masculine, have a low uncertainty avoidance, are long-term oriented, or indulgent. Nevertheless, the aforementioned studies take into account one cultural dimension at a time and neglect the impact of cultural specificity. This reflects the global effect of all cultural dimensions, and it is based on the fact that "when all the cultural dimensions are considered together, each country is a heterogeneous cultural mosaic, with a unique and distinctive cultural profile" (Gupta et al., 2018, p. 227). Starting from these and in line with King et al. (2014, p.175) who sustain that "understanding these differences and being able to adapt the review process to meet these needs are critical to retailers so that they can design systems that provide this information in the best manner possible", it can be argued that:

H2: The emotions shared through online reviews are positively influenced by customers' cultural specificity.

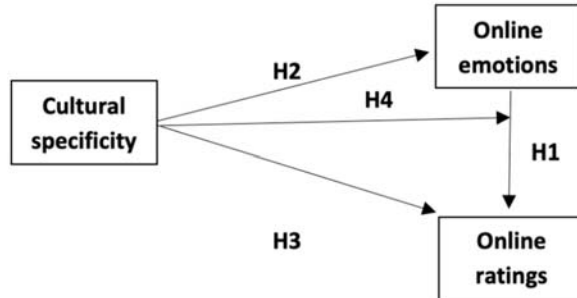
Gao et al. (2018) claim that those who come from a high-power distance culture provide low ratings while Mariani and Predvoditeleva (2019) argue that the higher the levels of individualism, masculinity, uncertainty avoidance and power distance, the lower the hotel's online ratings. Moreover, Radojevic et al. (2017) emphasize the moderate effect of culture on hotel's ratings by demonstrating that, in about 95% of all possible cross-cultural combinations, culture is expected to have an impact of less than ± 0.2 on ratings. Starting from these findings and taking into account the fact that online ratings are the result of an internal evaluation process based on a continuous comparison between the perceived reality and customers' expectations, values, and beliefs, it can be claimed that:

H3: Customers' cultural specificity negatively influences hotel's online ratings.

Nevertheless, according to Leon (2019) and Tseng (2017), the hotel guests who come from high-power distance culture, are individualists, are feminists, belong to a high uncertainty avoidance culture, are long-term oriented or indulgent tend to deviate from the prior average ratings. In other words, the ratings reflect not only customers' emotions during the accommodation but also the image they are willing to promote within the online community about themselves. Against this backdrop, customers may be willing to adjust their reviews and ratings in order to achieve congruity. Thus, the following hypothesis can be made:

H4: Customers' cultural specificity has a mediated effect on ratings through the emotional content of the review.

Figure no. 1. Conceptual model



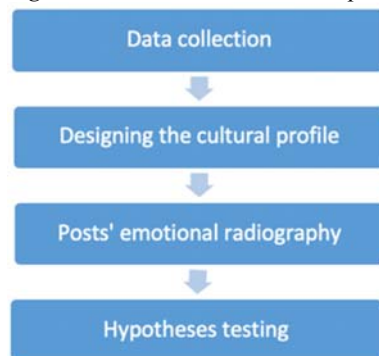
Source: Authors' own elaboration

Synthesizing, the conceptual model (Figure no. 1) is developed based on the relationships established among three variables, namely: (i) cultural specificity; (ii) the emotional content of online reviews; and (iii) online ratings.

3. Research methodology

The analysis focuses on analyzing the relationships established among three variables, namely: (i) cultural specificity; (ii) the emotions incorporated in online reviews; and (iii) online ratings. Thus, data collection and processing is a multistage process (Figure no. 2), and it is based on two sources, such as the Booking.com platform and Itim International (2017).

Figure no. 2. Data collection and processing



Source: Authors' own elaboration

Stage 1. Data collection: Using a web crawler, 5445 reviews, and 5575 ratings, posted from September 2022 until March 2025 on Booking.com, are extracted. This platform is chosen due to the fact that: (i) the reviews are 100% verified (only those who acquired the service through Booking.com can write a review and evaluate the service), and (ii) it was successfully used in previous studies (Mariani et al., 2019; Rodriguez Diaz & Espino-Rodriguez, 2018).

Given the research goal, the analysis concentrates only on those 5445 customers who decided not only to rate the hotel but also to present their experience in a comment. Data are organized around three criteria, such as: (i) customer's nationality; (ii) the rating provided by each customer for the hotel's services; and (iii) customer's comment. Preliminary results show that the hotel's customers came from 77 different countries and rated the service from 2.4 to 10, on a scale of 1 to 10.

Stage 2. Designing customers' cultural profile: A cultural profile is designed for each customer, using nationality as a proxy for cultural specificity (Alcántara-Pilar et al., 2017; Yates & de Oliveira, 2016). Although various differences appear among individuals, the national culture: (i) uniformly impacts the members of a society in a similar manner; (ii) it is based on the law of big numbers; and (iii) it reflects what is generally accepted within the society (Itim International, 2017; Hong et al., 2016).

Thus, cultural specificity is operationalized based on Hofstede's cultural dimensions and it focuses on: (i) power distance (PD); (ii) individualism (IDV); (iii) masculinity (MAS), (iv) uncertainty avoidance (UA); (v) long term orientation (LTO); and (vi) indulgence (IND). Data regarding countries' scores for each of these dimensions are retrieved from Itim International (2017).

Stage 3. Posts' emotional radiography: The 5445 reviews are either written in English or in customers' mother tongue. Each and every one of them is analyzed using Lexalytics® in order to determine its emotional content. This: (i) acts as an add-in for Excel; (ii) it uses Boolean queries, sentiment phrases, custom entities, and concept topics; and (iii) it is highly used in the hospitality, healthcare, and retail industries (Lexalytics, 2017). Besides, it is based on a lexicon and it makes the distinction among negative, neutral and positive emotions by providing an overall score that ranges from -1 (negative emotions) to 1 (positive emotions). Hence, at the end of this phase, each review has a score that indicates whether customers' emotions are positive, neutral, or negative.

Stage 4. Hypotheses testing: The relationships established among the research variables (cultural specificity, reviews' emotional content, and online rating) are analyzed. Within this framework, Partial Least Square – Structural Equation Modeling (PLS-SEM) is applied as: (i) it is a versatile technique, capable of testing path models (Marcoulides et al., 2009) and dealing with both formative and reflective constructs (Zhang, 2009). Besides, this approach is suitable for the current research due to the fact that: (i) the analysis is concerned with testing a theoretical framework from a prediction perspective and the assumed cause-and-effect relationships are not sufficiently explored (Hair et al., 2019); (ii) the research is based on secondary data (Hair et al., 2019; Henseler et al., 2018); and (iii) the path model includes formatively measured constructs (Hair et al., 2019). In other words, the use of PLS-SEM is appropriate because this study aims to extend an existing theory towards the new cross-cultural online behavior area and the causal relationships present a relatively new approach for the hospitality market.

Furthermore, in order to assess the statistical model's predictive power, PLSPredict is employed. This "offers a means to assess a model's out-of-sample predictive power (i.e. a model's accuracy when predicting the outcome value of new cases)" (Shmueli et al., 2019), and brings forward three dimensions, namely: (i) predicting construct versus manifest items; (ii) predicting in-sample versus out-of-sample cases; (iii) generating average-case prediction versus case-wise predictions. The predictive power of the model is established by comparing the root means squared error (RMSE) values of PLS-SEM and naïve linear regression model (LM) benchmark. Thus, according to Shmueli et al. (2019), the predictive power of the model is (i) zero if the RMSE values of PLS-SEM are smaller than those of LM for none of the indicators; (ii) low if the RMSE values of PLS-SEM are smaller than those of LM for a minority of the indicators; (iii) medium if the RMSE values of PLS-SEM are smaller than those of LM for a majority of the indicators; or (iv) high if the RMSE values of PLS-SEM are smaller than those of LM for all the indicators.

4. Findings

According to convergent validity, the measurement model is adequate. All items meet the acceptable limits suggested by Hair et al. (2014). Thus, the composite reliability is higher than 0.7 and the average variance extracted (AVE) overcomes the level of 0.5.

The model is also adequate if the discriminant validity is taken into consideration. As it can be observed from Table no. 1, the model complies with the Fornel Larcker criterion and also with the Heterotrait-Monotrait (HTMT) ratio of correlation criterion. According to the former, the model is valid due to the fact that the values of the diagonal elements are higher than other values in their respective rows and columns; thus, there are no correlations higher than AVE. According to the latter which measures the mean value of the item correlations across constructs relative to the geometric mean of the average correlations, the discriminant validity is not an issue due to the fact the value of the HTMT ratio is less than 0.85 (Henseler et al., 2015).

Table no. 1 Discriminant Validity

	Cultural specificity	Online emotions	Online ratings
Fornel Larcker criterion			
Cultural specificity	0.786		
Online emotions	0.442	1.000	
Online ratings	0.073	0.538	1.000
Heterotrait-Monotrait (HTMT) ratio of correlation criterion			
Cultural specificity			
Online emotions	0.383		
Online ratings	0.094	0.538	

Source: Authors' own elaboration

The results show that cultural specificity explains 19.5% of online emotional content variability while 32.3% of online rating variability can be explained by both cultural specificity and the emotional content of online reviews. In other words, cultural specificity influences both the emotions shared through online reviews and customers' ratings; besides, the rating is in accordance with customers' emotions.

Given the path coefficients, it can be stated: (i) if cultural specificity increases by one standard deviation from its mean, the emotions shared through online reviews would be expected to increase by 0.442 its own standard deviation from its own mean, while all the other constructs remain constant ($t=7.218$; $p=0.001$); (ii) if cultural specificity increases by one standard deviation from its mean, the online ratings would be expected to decrease by 0.205 its own standard deviation from its own mean, while all the other constructs remain constant ($t=2.02$; $p=0.044$); and (iii) if the emotions shared through online reviews increases by one standard deviation from its mean, online ratings would be expected to increase by 0.628 its own standard deviation from its own mean, while all the other constructs remain constant ($t=8.973$; $p=0.001$).

Nevertheless, it must be noticed that the emotions shared through online reviews are influenced by cultural specificity (they act as a dependent variable) and they influence online ratings (they serve as an independent variable). Therefore, if cultural specificity increases by one standard deviation from its mean, online ratings would be expected to increase its own standard deviation by at least 0.072 units; a decrease of 0.205 units would represent the direct effect that cultural specificity would have on online ratings while an increase of 0.277 units would represent the mediated effect. In other words, if cultural specificity increases by one standard deviation from its mean, the emotions shared through online reviews would be expected to increase by 0.442 its own standard deviation from its own mean; in turn, this will generate an increase by 0.277 units of online ratings. Furthermore, cultural specificity has a mediating effect of 0.28 on online ratings through the emotional content of the reviews.

Table no. 2 Testing the research hypothesis

Hypothesis	Relationship	St. dev.	T statistics	P values	Hypothesis validation
1	Online emotions -> Online ratings	0.07	8.973	0.001	Supported
2	Cultural specificity -> Online emotions	0.06	7.218	0.001	Supported
3	Cultural specificity -> Online ratings	0.10	2.019	0.044	Supported
4	Cultural specificity -> Online emotions -> Online ratings	0.05	4.810	0.000	Supported

Source: Authors' own elaboration

Hence, the four research hypotheses are validated (Table no. 2) since: (i) customers' emotions incorporated in online reviews positively influence hotel's online ratings ($\beta=0.628$; $t=8.973$; $p<0.05$); (ii) the emotions shared through online reviews are positively influenced by customers' cultural specificity ($\beta=0.442$; $t=7.218$; $p<0.05$); (iii) customers' cultural specificity negatively influences hotel's online ratings ($\beta=-0.205$; $t=2.019$; $p<0.05$), and (iv) cultural specificity has a positive mediating effect on online ratings through the emotional content of the reviews ($\beta=0.28$; $t=4.81$; $p<0.05$).

Table no. 3 PLSPredict assessment

Construct	PLS-SEM		LM		PLS-SEM - LM
	RMSE	$Q^2_{predict}$	RMSE	$Q^2_{predict}$	RMSE
Online emotions	0.413	0.164	0.406	0.194	0.007
Online ratings	1.886	-0.020	1.891	-0.026	-0.005

Source: Authors' own elaboration

The model's predictive power is tested using PLSPredict and according to data presented in Table no. 3, the model has a low prediction power. The constructs outperform the naïve benchmark only in the case of the online emotions ($Q^2_{predict} > 0$) and the differences between the RMSE values of PLS-SEM and those of naïve LM are negative only for one out of two constructs, namely, online ratings (PLS-SEM based RMSE=1.886; LM based RMSE=1.891).

5. Discussions and conclusions

The current research analyzes the influence of the cultural specificity on reviews' emotional content and customers' ratings. Thus, the main results show that: (i) reviews' emotional content has a positive influence on hotel's ratings; (ii) customers' cultural specificity influences both the emotions shared in a review and the ratings, but its direct effect is positive in the first case and negative in the second one; and (iii) customers' cultural specificity has a positive mediated effect on ratings through emotions. Furthermore, it brings forward that customers' positive emotions tend to be generated by the hotel's intangible assets (such as comfort and employees' attitude) while the negative emotions are related to tangible assets (like location and price).

Nevertheless, although the model has a low prediction power, the results indicate that online ratings produce a better prediction than the emotional content of customers' reviews. Hence, it is surmised that the model using online ratings is an efficient tool to explain customers' online behavior when cultural specificity is taken into account.

These findings have both theoretical and practical implications. At the theoretical level, the current research is situated at the nexus between cross-cultural management and hospitality management, and it emphasizes the influence of cultural specificity on customer online behavior (especially, reviews and ratings). Thus, it complements the findings of López Barbarosa et al. (2015) and Antonio et al. (2018) who argue that the percentage of positive reviews can predict the overall hotel ratings. On the one hand, it shows that reviews' emotional content has a positive influence on ratings. On the other hand, it goes further and emphasizes that the hotel's intangible assets generate positive emotions while the tangible ones tend to be associated with negative emotions. Unlike the aforementioned studies, it considers also the link between negative reviews and ratings, and it identifies their sources.

Furthermore, the current results are in line with Geetha et al. (2017) who state that the variation in customer ratings is explained by reviews' emotional content. However, they complement these findings by bringing forward the case of a standard/comfort category hotel. Thus, while Geetha et al. (2017) argue that reviews' emotional content explains 44% of the variation in customer ratings, for budget category hotels, and 21% of the variation in customer ratings, for premium category hotels, the current research shows that, in a standard/comfort category hotel, if the reviews' emotional content increases by one standard deviation, the ratings are expected to increase by 0.628. Moreover, the importance of cultural specificity is unveiled by highlighting that 32.30% of the variation in customer ratings is explained by reviews' emotional content and customers' cultural specificity.

Against this backdrop, it can be argued that the current research extends the literature from the hospitality field by bringing forward the net effect of cultural specificity. Unlike the previous studies which analyze the impact of each cultural dimension on the online customer behavior (Huang & Crotts, 2019; Leon, 2019; Mariani & Predvoditeleva, 2019), this study reveals the interdependences developed among the cultural dimensions. Thus, it asserts that online customer behavior (especially, reviews and ratings) is the result of these interdependencies and not a consequence of a certain cultural dimension. This approach is in line with Gupta et al. (2018, p.227) who specifies "when all the cultural dimensions are considered together, each country is a heterogeneous cultural mosaic, with a unique and distinctive cultural profile". Thus, an integrative perspective is required since no customer comes from a single cultural dimension society and the hotel managers have to understand their customers in order to better adapt to their requirements.

At the practical level, the current study emphasizes the elements on which hotel managers should concentrate on and it also helps them to understand why their customers behave differently in an online environment. Along, it facilitates managers' access to the cultural and behavioral profile of their customers, and it highlights several strengths and weaknesses from the customers' perspective. Yet, given these results, the hotel's managers could use this study as a starting point for:

- adapting their services to international customers' expectations. Knowing the elements that tend to generate positive emotions among customers and customers' cultural profile, the hotel managers can provide slightly personalized services. Since customers' cultural specificity has a positive influence on reviews' emotional content and the latter tends to be positive when associated with intangible assets such as employees' attitude, the hotel managers can recommend to their employees to pay special attention to those customers who have a high level of cultural specificity. Besides, they can design specific service packages for their customers, based on their cultural specificity.
- identifying fraudulent reviews. A significant difference between the emotional content of a review and its associated rating signalizes the presence of a fake review. This generates frustration (at the management and employees' level) and it also affects the hotel's image and reputation. Therefore, its identification helps managers deal with it promptly by understanding its content in a better way.

Furthermore, these results are also useful for review aggregators and online practitioners who must consider various approaches that encourage or deter certain online behavioral patterns.

Despite these findings, the research is limited by the fact that: (i) the analysis focuses on a single case-study, and (ii) it overlooks the influence that customers' language ability could have on their reviews. Therefore, future research can explore: (i) which other cultural factors (age, gender, religion, status) influence customers' emotions and ratings; (ii) why do customers decide to share their experiences in an online environment; and (iii) how does cultural specificity influence the expression of specific emotions (joy, anger, disappointment, excitement, etc.) in an online environment.

6. Acknowledgments

The research reported in this paper is supported by the Research Vice-Rectorate of Universitat Politècnica de València (UPV) for the project "Knowledge Sharing Strategies for Industry 5.0 transition" (PAID-06-23) / Financiado con Ayuda a Primeros Proyectos de Investigación (PAID-06-23), Vicerrectorado de Investigación de la Universitat Politècnica de València (UPV).

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The Effects of Marketing Strategies on Parents' Buying Behavior. Case Study: Baby Food Market

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Abstract

The food market for children and babies is a dynamic and constantly expanding segment, influenced by the growing concerns of parents for healthy nutrition and food safety of their little ones. Every day, parents must make informed choices to select healthy and nutritious products suitable for the needs of their children. At the same time, they are exposed to various marketing strategies used by manufacturers to attract, influence, and retain consumers. This article analyzes the marketing strategies applied in this sector and highlights their impact on parents' decisions. For this purpose, a quantitative marketing study was conducted among Romanian parents.

Key words: children, food market, marketing strategies, quantitative market research, buying behavior

J.E.L. classification: M31, D12, L66, C83

1. Introduction

The market encompasses any investment opportunity and any moment in which potential business partners, sellers, or buyers of products or services can connect. It appears as a network of interpersonal relationships and business relationships that arise inevitably between almost all categories of agents in society.

Today, no one doubts the necessity of product promotion strategies. However, not only are these important, but also the product strategies, noting the permanent need for innovation and updating, the price strategies, and the distribution strategies (in this case, continuous research of the various distribution channels must be done so that the company and its products can reach the target market). The elaboration of marketing strategies does not consider the market in general, but a certain market well determined from a spatial, temporal, social-demographic, and economic point of view. Economic strategy is a complex concept that establishes how to achieve the objectives adopted by the company, the actions to be taken, how to allocate resources, how to respond optimally to changes in the environment, and to be competitive with competing companies (Negricea, 2009, p.114).

The strategy aims to place the company in a position from which it can compete effectively and survive in the market. The strategy can be defined as the set of major long-term objectives of the organization, the main ways to achieve them, along with the resources allocated to obtain the competitive advantage according to the mission of the organization (Nicolescu, 2002, p.104).

The food market for infants and children in Europe is very developed and currently offers a wide range of products: infant formula (0 - 1 year), breast milk for young children (from one year up), infant cereals, purees, juices, biscuits, desserts, and teas. Even so, most of the producers on the market sell only a small assortment of their international portfolio, depending on the country, a strategy directly in line with the market's demand and level of development. Any product that, through its properties, meets the needs of other people than its producers is called a commodity. Food commodities are part of the immediate-need goods group; without them, man cannot live (Madar et

al, 2004, p.21-37).

The competition is very fierce in the food market for children and infants, so in order to survive and develop, companies must know their market well and operate and develop different marketing strategies. Recently, a new concept has emerged, that of "green marketing", which involves specific strategies, with the purpose of not only bolstering their reputation but also of improving their awareness, increasing their trust or enhancing the target groups' appeal for the company. These actions will help customers see the company in a better light. Once a proper, positive, and proactive image develops in consumers' minds, the chance of gaining their loyalty is significantly increased, thus leading to a greater competitiveness of the company and higher effectiveness in approaching the target market (Dabija et al, 2013, p.8; Wood et al, 2021, p.9).

This article aims to identify the marketing strategies applied in the food market for children and to provide a clear picture of the impact of marketing strategies and techniques on attracting and influencing parents. In this regard, quantitative marketing research was conducted on 630 parents aged between 20 and 50. The obtained results reveal that the parents, although they do not realize it, are influenced by the marketing strategies applied in this market.

2. Analysis of marketing strategies applied on the infant's food market

Marketing strategies define how to achieve specific marketing objectives. First, it is essential to establish the strategy, followed by preparing the component action plans and specific action plans of the marketing plan (Butkovic et al, 2014, p.508; Morgan et al, 2019, p.4). Within the strategic plan, we can identify market strategies corresponding to each marketing environment element (product, price, distribution, and promotion) (Kumar et al, 2012, p.482). The marketing strategy represents the main directions of activity towards which the enterprise is oriented (Keller, 2008, p.24). It aims at a set of "long-term" actions that mobilize human, financial, and material resources, in order to achieve, in a specific period, the objectives set and, implicitly, to strengthen the company's market position. It is implemented with the help of tactics, techniques, and a well-defined instrumentation (Kotler, 2008, p.47). The marketing strategy is a plan that helps coordinate and improve long-term marketing efforts. It aligns with marketing policy principles to achieve market objectives effectively (Varadarajan, 2015, p.80; Sheth, 2021, p.3).

Regarding product strategies, the following strategies can be identified that companies can choose:

- Strategies regarding the size of the assortment range: these allow the diversification, maintenance, or restriction of the assortment range of the company according to its needs;
- Strategies regarding the quality of the products and services offered: these are the following: qualitative adaptation strategy, qualitative differentiation strategy, qualitative stability strategy
- Strategies regarding the degree of novelty of the products and services offered, depending on the degree of novelty, the strategic options that a company can opt for are: the strategy of assimilating new products, the strategy of perfecting the products, and the strategy of maintaining the degree of novelty;
- Strategies regarding how to approach local preferences, these target companies that operate in several markets, raise the issue of choosing between standardization and adapting products to local preferences (Ionescu, 2007, p.7).

Unlike the product's characteristic attributes and arrangements made with the distribution channels, the price can be changed in a very short time. Price can make the product more tangible by conveying perceptions of quality, reducing variability through appropriate strategic differentiation, and mitigating the effects of perishability and inseparability (Kotler et al, 2008, p.419). In the organization of a business, price flexibility is an essential mechanism that stimulates the creation of goods and removes bottlenecks caused by overproduction (Lefter et al, 2006, p. 454).

The promotion policy aims to communicate to the target markets through various promotional techniques and media, and the promotion strategies are the steps that ensure the achievement of the objectives of the promotion policy within the marketing policy and the organization's global policy (Ivanov, 2012, p.53).

The main criteria according to which promotional strategies can be structured are the global objectives of the promotional activity, how it is carried out over time, the role of the promotional activity, its position in relation to the market structures, the location of the promotional activity, and the type of motivation (Petrescu, 2009, p.114).

In the case of international marketing, there are two strategies:

- standardized advertisement;
- adapted advertising.

Standardized advertising uses the same ads at home and abroad, providing a consistent message in all markets the company wants to enter. In contrast, adapted advertising changes the message to suit the cultural needs of specific markets where the company operates (Cervellon et al, 2000, p.429).

Although it seems stable, the market for baby products is quite unpredictable, given that birth fluctuations can increase or decrease the number of consumers and sales of specific products. Unlike other products, the baby food category shows neither seasonality nor regionality. Instead, producers are talking about a differentiation in the market's growth rate. Factors influencing development are the area's economic growth, the expansion of modern retail, and access to information. Naturally, this category enjoys a higher degree of penetration and consumption in large cities.

The food market for infants and children in Romania has developed rapidly in recent years. It offers a wide range of products: milk formulas for infants (0-1 years), growing milk for young children (from one year to above), baby cereals, purees, juices, biscuits, desserts, and teas. Even so, most of the manufacturers present on the market only sell a limited assortment from their international portfolio, a strategy directly in line with the demand and the level of development of the market.

Analyzing the market for products for infants and children from the point of view of the main producers, it can be said that it is homogeneous, divided mainly between names and internationally renowned brands. The main players on the market are Nestlé, Milupa (with the brands Milupa, Aptamil, Milumil, and Bebelac), Humana, Hipp, and Parmalat. In addition, there are also smaller players on the market, some even locally.

The strategy for compiling the assortment range differs from case to case, some manufacturers rely on a wide and varied range, on the principle that it is very important to have products for any type of need and for each stage of development (such as Milupa), and other companies rely on organic marketing strategies, for example, by going for an offer of exclusively organic products (such as Topfer). Even so, if in some European countries such as France or Spain the range of a large producer can include 200 assortments, in other European countries, it sells only about a quarter of the products.

Existing European nutrition legislation regulates promotion issues, based on recommendations made by the World Health Organization (WHO). The measures aim to stop the declining trend in the importance and duration of breastfeeding, a trend influenced by both socio-cultural factors and promotion campaigns of substitute producers, who are obliged to educate and inform buyers about the superior benefits of breastfeeding.

Companies in this market use different strategies to promote products, especially through media channels (Madar, 2018, p.178; Cairns et al, 2013, p.214). Nestlé supports numerous campaigns to communicate, educate, and inform mothers through direct communication channels for mothers with infants over 6 months, in the case of diversification products, and young children over 1 year, in the case of breast milk formulas. At the same time, Nestlé constantly provides the latest scientific information to doctors, pharmacists, nutritionists, other scientists, and provides a basis for discussions between specialists around the world through the Nestlé Nutrition Institute, which provides them with a website dedicated to specialists, workshops, books, magazines, etc.

The level of education of young mothers also influences their perception of the products and their costs. Thus, the Milupa Romania company adapted its product portfolio according to the children's nutritional pyramid, built according to the different stages of growth and the related needs. In terms of innovations, Milupa also launched Aptamil Junior 2 years + with Immunofortis. The packaging is innovative, designed as an easy-to-use pack that mothers can handle with one hand, while also being safe from a hygiene perspective.

For example, Milupa offers baby food in the premium price segments with the Milupa and Aptamil ranges and in the mainstream with the Bebelac brand. The portfolio includes over 34 teas, milk formulas, and cereal products.

In terms of distribution, most companies in this market target both pharmacy chains and Key Account channels. Because mothers trust the advice of a specialist, they go to pharmacies to ask for information about baby products. Here, together with the pharmacist, the recommended dose is determined, and the product is bought. In the next acquisitions, out of the desire to pay a more advantageous price, they are oriented towards modern retail. That is why the big players in this market, such as Milupa and Nestle, focus on promotions in store chains.

Satisfying the consumption needs of the population in a civilized society implies the existence of a wide range of products.

Therefore, design and aesthetic elements in the packaging of infant products play an important role in product strategies (Neacsu, 2019, p.284).

3. Research methodology

The research conducted and presented in this article was quantitative in nature. It aimed to identify and analyze how marketing strategies influence parents' decisions to buy baby food.

The paper's main objective is to clearly illustrate how parents perceive companies' marketing strategies in the children's food market.

The quantitative research method used was a survey-based investigation, and the basic instrument with which the data was obtained was the questionnaire.

The specific objectives based on which the research was designed were:

- Identifying respondents' opinions on child nutrition;
- Determining the reasons why adults choose to buy certain brands of food for their children;
- Identifying the influence of marketing strategies in the choice of food by parents for their children;
- Identifying the influence that promotion has in the choice of food by parents for their children.

Data were collected using a structured questionnaire consisting of 22 questions (2 filter questions, 15 core questions, and 5 identification questions).

The sample included a number of 630 people, who met the necessary conditions to achieve the purpose and objectives of the research. The eliminatory condition was that the respondents had babies or infants. The sample was structured as follows: 61.9% from the urban environment and 38.1% from the rural environment. As shown in Table 1, the majority of respondents (31.23%) are between 36 and 50 years old, followed by those aged between 25 and 35 (23.42%).

Tabel no. 1 Descriptive information of survey participants

Categories	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 20 - 25 years	88	13.97	13.97	13.97
26 - 30 years	127	20.14	20.14	34.11
31 - 35 years	176	27.94	27.94	62.05
36 - 40 years	153	24.29	24.29	86.34
41 - 45 years	68	10.8	10.8	97.14
46 - 50 years	18	2.86	2.86	100.0
Total	630	100.0	100.0	

Source: Authors' own research

Due to the significant geographical dispersion of the respondents and for easier data collection, the survey was conducted through Google Forms using computer-assisted web interviewing (CAWI). The survey was conducted between April 10 and May 10, 2024.

The collected data were entered into a manually coded database and analyzed using the IBM Statistical Package for Social Sciences (SPSS). In order to understand how parents perceive the marketing strategies applied by companies in the children's food market, the analysis focused on descriptive statistics and cross-tabulations.

4. Results and discussion

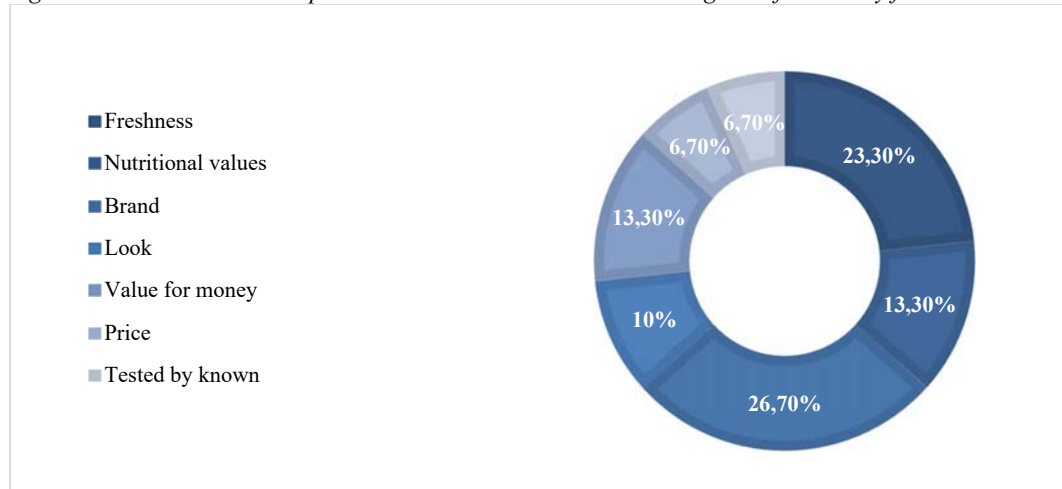
The results of the research were analyzed and are structured on the four specific objectives.

Objective 1. Identifying respondents' opinions on child nutrition

The respondents are aware that a healthy diet for young children should include fresh, natural, home-cooked meals. They believe that children should have three meals a day, with a focus on food diversification. Nutrition should be part of a healthy lifestyle that also includes physical activity for the little ones, helping to prevent health issues caused by a lack of exercise. Participants were also asked to identify potential health problems in infants that could result from poor nutrition. Diabetes and obesity are the conditions identified by the interviewed subjects. Diabetes in children is often genetically inherited, but can also be caused by excessive sweets.

The main criteria according to which respondents choose products for feeding children are freshness (23.3%), nutritional values (13.3%), brand (26.7%), appearance (10%), value for money (13.3%), and price (6.7%), but also whether they have been previously tested by them or close ones (6.7%). As shown in Figure 1, respondents primarily choose food for their children based on the brand and the product's freshness.

Figure no. 1. The criteria that parents take into account when choosing what food to buy for their children



Source: Authors' own research

Most respondents mentioned that they mostly prepare children's food at home but that they sometimes also use ready-made food due to a lack of time. Although the subjects know the rules of a healthy diet for children, due to lack of time they choose to buy less healthy foods, most subjects (58%) although they are aware that semi-prepared foods are not as healthy as those prepared at home, choose to buy these products due to lack of time. The other respondents offered options such as: healthy food that they prepare quickly, vegetables to cook on the grill, ready-made purees, choose foods to make soup even if they do not have much time.

The respondents stated that they choose the best, organic, natural food with the most nutrients for their children, which ensures a high intake of vitamins, especially for their age, as recommended by the doctor. These statements, however, contradict the moment when they do not have enough time to cook healthily and choose ready-made products or to satisfy certain pleasures of their children.

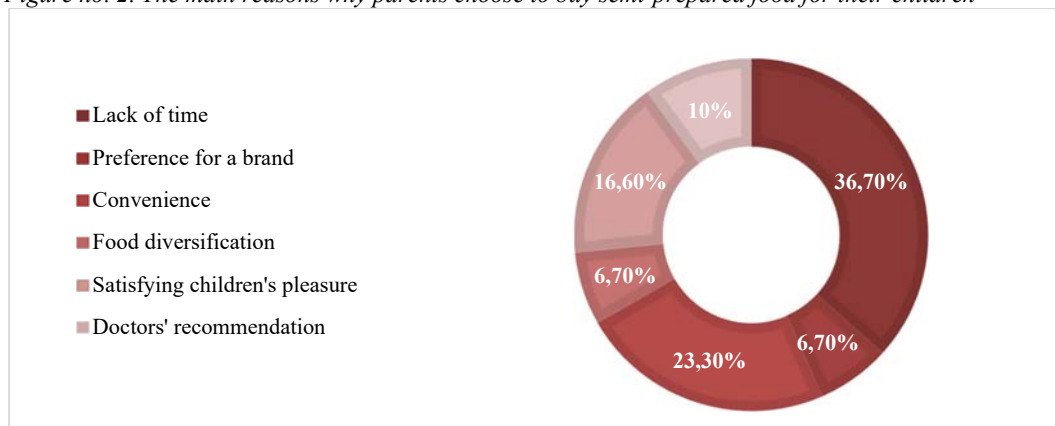
Another topic was that of the food chosen for the child up to two years old. Most subjects chose the powdered milk option for their baby. The reasons listed were that they did not have breast milk for too long, it is healthier than cow's milk, the doctor recommends it, and it helps the baby's normal development. Those who opted for breast milk, instead of powdered milk, pointed out that it ensures babies' immunity, or that the baby did not accept the bottle. Respondents said that semi-prepared food is sometimes useful because they do not always have time to cook, although it is unhealthy and creates health problems, as it does not have the necessary intake of nutrients and has additives. At the same time, the semi-prepared food is the joy of the little ones because it tastes good.

For children over the age of two, most respondents (72%) said that at breakfast, they offer their child milk with cereal, fruit puree with biscuits, fruit and vegetable juice, toast with jam, butter, and tea.

Objective 2. Determining the reasons why adults choose to buy certain brands of food for their children

The main reasons (Figure 2) for which respondents buy ready-made food for babies are: lack of time (36.7%), preference for a brand (6.7%), convenience (23.3%), food diversification (6.7%), children's pleasure satisfaction (16.6%), doctors' recommendation (10%).

Figure no. 2. The main reasons why parents choose to buy semi-prepared food for their children



Source: Authors' own research

Regarding food safety, the subjects, especially mothers, mentioned an interesting aspect, namely that baby foods are safe being pre-tested and recommended by doctors, as opposed to those for preschool children, which are not so safe, they contain additives and, in addition, do not have the same nutritional values as those made at home.

Among the companies producing baby food, the respondents listed: Nestle on the first (36%), followed by Milupa with 22%, Aptamil (which also belongs to Milupa) and Hipp, both with 11% and on the last place Topfer (10%) and Humana (10%).

Objective 3. Identifying the influence of marketing strategies in the choice of food by parents for their children

First, this topic was about finding out where parents buy food for their children. The supermarket option came in first place with a score of 75%, and in second place with a score of 25%, the respondents answered that they buy food for their children from pharmacies. The authors aimed to determine whether price influences the decision to purchase baby food. Thus, 37.5% of the subjects stated that the price does not matter when they choose food for their children, mentioning that they always choose what is best and what the doctor recommends to them regardless of price, and 62.5% of the respondents stated that in the purchase process they also take into account the price. Among the reasons mentioned in this last statement is the lack of a large budget to choose the most expensive products, but also the fact that they can buy more products if they choose a lower price or buy at a promotion.

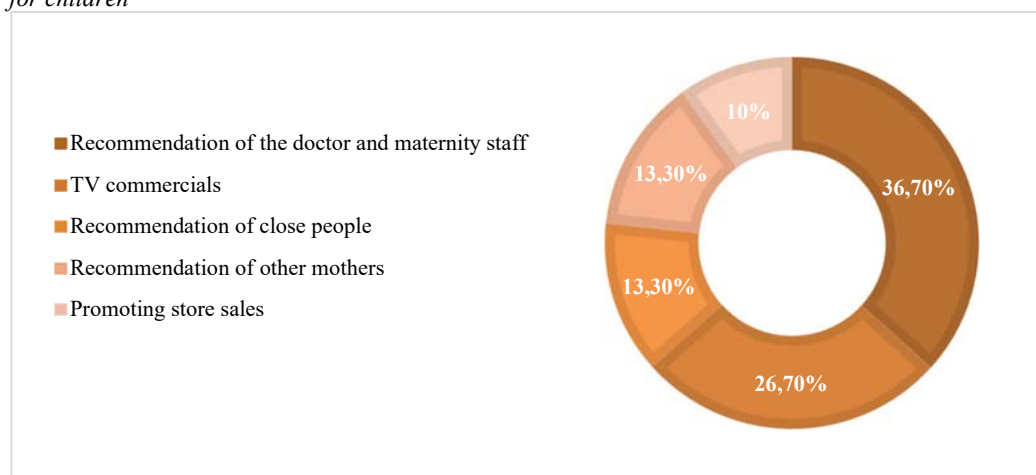
In relation to the product itself, the aim was to determine which characteristic is most important when choosing food for infants and young children. The most frequently mentioned aspect was the packaging. Respondents preferred packaging that is as transparent as possible, allowing them to see the contents. They also valued packaging that is easy to transport and store, and they paid close attention to the information displayed on the label, especially elements that highlight features distinguishing the product from competitors. The degree of novelty was another important feature for mothers when choosing a baby food product, the new products being often superior to the others in their range, with new and improved properties. The label is also important, the ingredients must be written clearly, looking for natural products, without additives, dyes, and artificial preservatives,

and the label also looks for the expiration date written clearly. Respondents also mentioned quality and brand, expressing a preference for well-known products that are easily recognizable and of superior quality.

Objective 4. Identifying the influence that promotion has in the choice of food by parents for their children.

For most subjects, the decisive factor that led them to choose a certain food company for babies was the recommendation of the doctor and the maternity staff (36.7%), followed by TV commercials (26.7%), the recommendation of close people (13.3%), recommending other mothers with whom they interact (13.3%) and promoting sales in stores (10%) (Figure 3). We can deduce that the subjects take into account, first of all, the recommendations of the qualified staff when choosing the food for their children, and then the rest of the factors, so the companies present should turn their attention to family doctors, pediatricians, and maternity staff to increase sales volume.

Figure no. 3. The decisive factor that contributed to the choice by the subjects of a certain brand of food for children



Source: Authors' own research

The companies best rated by the interviewed subjects are: Nestle, followed by Hipp, Aptamil, Milupa, Humana, and Topfer. The subjects stated that promotion is essential when buying a company's products, taking into account primarily the recommendations of family doctors, maternity staff, pediatricians, TV commercials, promoting sales in stores and pharmacies, and recommendations of friends. Moreover, the other mothers he comes in contact with. 75% of respondents stated that they buy baby food from the supermarket and only 25% buy it from pharmacies and of these 62.5% are influenced by the price of the products and only 37.5% consider that price is not a criterion when choosing food for their children, buying what they recommend qualified staff regardless of price.

In the current conditions of economic and social dynamism, the successful presence of a company on the market is increasingly difficult. Competition is extreme in most fields of activity, so to survive and develop, the company must know its market well. To achieve this, the company must communicate with the market, it must inform its potential customers about its existence, about the ways in which the products it offers can come into their possession, but also about the characteristics of the products sold and the price, but also to and set very well the strategies for achieving the goals.

Establishing a marketing strategy is probably the most complex marketing activity any company must undertake. The process must evaluate the company's current situation, establish the objectives that the company proposes, and concretely achieve them using the existing resources and those available in the future, realistically estimated (material, human, competitive advantages), in the most efficient way possible.

Analyzing the market of products for infants and children from the point of view of the main manufacturers, we can say that it is a homogeneous one, mainly divided between names and brands of international renown. The first five manufacturers present in the market, through their representation or importers, are Nestlé, Milupa Romania (with the Milupa, Aptamil, Milumil, and Bebelac brands), Humana (Vavian Pharma importer), Hipp (Consumer Product Network importer), and Parmalat. The brands Hamé (Hamé Romania), Hero (Ulker), Topfer, or Nutriben (Romagra Distribution) can also be found on the shelf.

Firms in this market use different strategies to promote products, primarily through media channels. Nestlé supports numerous campaigns to communicate, educate and inform mothers through direct communication channels for mothers with infants over 6 months, in the case of diversification products, and young children over 1 year, in the case of growth milk formulas. At the same time, Nestlé constantly provides doctors, pharmacists, nutritionists, and other scientists with the latest scientific information and provides a basis for discussions between specialists from around the world through the Nestlé Nutrition Institute, which provides them with a website dedicated to specialists, workshop books, magazines, etc.

Young mothers' education level also influences their perception of products and costs. Thus, the Milupa Romania company adapted its product portfolio according to the children's nutritional pyramid, built according to the different stages of growth and related needs. In terms of price, the Milupa company entered the Romanian baby food market in the premium price segments with the Milupa and Aptamil ranges, and the mainstream, with the Bebelac brand

Following the research, the company most chosen by the interviewed buyers is Nestle, followed by Hipp, Aptamil, Milupa, Humana, and Topfer. Mothers stated that promotion is very important when they decide to purchase a company's products, primarily taking into account the recommendations of family doctors, maternity staff and pediatricians, but also TV commercials, sales promotion in stores and pharmacies and recommendations of friends and other mothers with whom they come into contact. Regarding the product itself, the most important feature identified is the packaging that must be transparent and easy to transport and store, the degree of novelty of the products, but also the label, brand, and quality of the products.

Thus, companies must produce products that are as natural as possible, without artificial E and dyes, that have an average price but are manufactured according to the latest quality standards, that have transparent packaging and appropriate labeling that can be observed to show product benefits. These products must be intensively promoted in maternity hospitals and through specialized doctors, TV commercials, and supermarkets where they buy the most.

The hypothesis that at least 60% of the respondents consider branded food products to be quality products was tested using the Student's t-test.

Tabel no. 2 Data obtained after applying the Student t test

	Test Value = 0.6					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Branded food products for babies are quality products	2.689	59	.009	.217	.06	.38

Source: Authors' own research

The results indicate that, with 95% confidence, less than 60% of the respondents believe that branded food products are of high quality.

The research aimed to determine if parents buy food products for babies and children, how much they know them, how they appreciate specific characteristics of these products, and if they are influenced by the new products displayed on the shelf or by promotions. Considering the fact that parents can easily inform themselves about how they can choose their child's nutrition through the

multitude of mass media, it is important for any company to know the preferences of mothers in conditions where the market is saturated with such products.

The main place where parents buy baby food is the supermarket, followed by pharmacies and hypermarkets. 63.3% of respondents agree with the statement that branded baby food products are good quality, and 25% showed indifference. Regarding the second statement (for me, choosing more expensive food products reveals the fact that they are healthier for the baby), 48.3% showed indifference, and 41.7% agreed.

Of the responses, 70% said they do not usually change the brand of food products for babies, and 30% stated that they do. Of those who answered "yes", 72.2% do this less often than 2 months, and 27.8% once every 2 months. The main reason mentioned for changing the brand of the products is related to the health problems caused by the child.

Regarding the extent to which the new products marked on the shelf influence the purchase of food products for babies, 35% of the respondents opted for level 3 of the scale, which represents the not a little/not much option. 11.7% mentioned that they are determined a lot by the new products displayed on the shelf in the purchase process, 30% are determined a little, and 23.3% are determined very little.

30% of the respondents mentioned that advertising influences the buying process a lot, and 33.3% mentioned that advertising does not influence the buying process either much or a little. Promoting baby foods is considered low by 63.3% of the respondents and normal by 36.7%.

Given that today's mothers are increasingly suspicious of ready-made baby food products, companies should offer the opportunity for mothers to taste the products in the store, thus offering the possibility of knowing the contents before purchase. Companies should try to innovate smart packaging, placing more emphasis on their safety and creating it in such a way as to allow food to be kept fresh for as long as possible, but also to be stored and transported easily and safely.

In the chapter of news at the level of purchasing behavior, manufacturers speak of a greater awareness of the fact that babies have different needs than adults and therefore need an appropriate diet. Buyers understand that baby food products, unlike home-made ones, have the optimal dose of each ingredient required for balanced nutrition.

Unlike other product categories, baby food exhibits neither seasonality nor regionality. However, manufacturers talk about a differentiation in the market's growth rate. The factors that influence the development are the respective area's economic growth, the expansion of modern retail, and access to information. Naturally, this category enjoys higher penetration and consumption in big cities.

5. Conclusions

Among the most important criteria in the purchase decision are advice from an authorized person, such as a pediatrician, the stage of the baby's development, aroma, and the ease of use of these products.

Most parents know what a healthy diet means and try to give their children the best. However, they admit that there are times when they give their children ready-made food bought in stores due to a lack of time, sometimes convenience, but also to satisfy certain pleasures of children. Mothers know almost all the health problems their children could have due to a poor diet.

Firms must provide products that are as natural as possible, without additives, that are manufactured according to the latest quality standards, with packaging that is as transparent as possible and appropriate labeling on which the benefits of the products can be observed. These products must be intensely promoted primarily in maternity hospitals and through specialized doctors, through TV commercials, but also in supermarkets where they are bought the most.

In order to face the increasingly fierce competition and meet consumers' desires, more and more companies in the market for baby food have begun to apply "green marketing" strategies, offering organic products with natural ingredients without additives. Even if they are more expensive, these products are preferred by parents, who want safe, healthy products for their children and who, due to a lack of time, cannot prepare them at home and buy the semi-prepared ones.

A limitation of the research is the statistical validation of the sample and the extrapolation of the results to the entire researched population. This limitation stems from the inability to implement random sampling techniques, but this limitation does not make the paper any less valuable.

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Study Concerning Organizational Culture Influences on Corporate Social Responsibility

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Abstract

This paper looks at the complex interaction between corporate social responsibility and organizational culture to grasp better how internal cultural elements affect the acceptance and integration of an entity's socially responsible activities. Through careful examination, researchers have identified specific cultural dimensions that catalyze or constrain CSR engagement across various organizational contexts. Using quantitative approaches, the study team compiled data from extensive surveys and subjected this material to advanced artificial neural network modeling analysis. The results confirm the leading theory—that company culture significantly corresponds with CSR performance and implementation. Among the many factors under investigation, value alignment and innovation orientation were powerful predictors significantly affecting CSR results. These findings underline the crucial role of creatively sensitive settings and culturally matched ideals in incorporating social responsibility inside the strategic framework of a company.

Key words: organizational culture, corporate social responsibility, value alignment, innovation orientation

J.E.L. classification: L21, M10, M14

1. Introduction

In recent decades, CSR has evolved as a sustainable and ethical corporate discourse pillar. Nonetheless, as Vărzaru and Vărzaru (2013a, 2013b) point out, the genuine integration of CSR within firms goes beyond just responding to external demands or regulatory compliance, drawing substantial influence from internal organizational dynamics—particularly culture. Organizational culture is a fabric of values, beliefs, and behavioral conventions that fundamentally impact how firms interpret, implement, and sustain CSR programs over time.

Linnenluecke and colleagues (2009) eloquently describe how firms understand and implement CSR via the unique lens of their cultural underpinnings. When businesses foster unified cultural frameworks, social responsibility organically thrives, dramatically impacting employee motivations, attitudes, and behaviors (Bocean, 2007a, 2007b, 2009, 2011). Organizations integrate CSR into their identity when their corporate culture promotes active engagement, transparent communication, and alignment of values across all levels of hierarchy. In these supportive settings, corporate social responsibility (CSR) blossoms into a genuine manifestation of the organization's core values, surpassing its function as a strategic checkbox or public relations tool (Alkhadra et al., 2023). Despite these revelations, the exact nature and degree of this cultural-CSR link are still up for question among academics. By pointing out that strong corporate culture does not always translate into better CSR performance, Jaakson and colleagues (2009) carefully question oversimplified correlations and emphasize the need for more complex, context-sensitive research methodologies.

Our study addresses these theoretical developments and empirical uncertainties by investigating the hypothesis that organizational culture positively influences CSR implementation. We employ a quantitative methodology, distributing structured questionnaires among a representative sample and analyzing the resulting data through artificial neural network modeling. This analytical framework excels at uncovering patterns and causal relationships within complex, nonlinear datasets. Our investigation explores how specific cultural variables—including innovation orientation, collaborative dynamics, leadership approaches, and value alignment—interact with multiple CSR dimensions encompassing environmental stewardship, community engagement, ethical business practices, and employee wellbeing.

This research enriches scholarly understanding of how internal cultural dynamics shape CSR implementation while offering pragmatic insights for organizations seeking meaningful alignment between their corporate values and broader societal and environmental aspirations.

2. Theoretical background

The perception and understanding of CSR within an organization are profoundly shaped by its governing culture, as Linnenluecke et al. (2009) emphasize. Organizational culture is a foundational framework that molds its members' values, attitudes, and behaviors, determining how CSR initiatives are integrated and promoted within the organizational structure.

A notable example is the influence of a "clan" culture on CSR. Smircich (1983) argues that such a culture, characterized by a strong emphasis on collaboration, engagement, and solidarity, fosters a positive attitude toward the organization. This cultural environment encourages active employee participation in CSR initiatives, cultivating a sense of belonging and collective responsibility. Workers are inspired to contribute significantly to the company's social and Sustainability objectives because they feel appreciated.

Additionally, CSR is transformed from a mere compliance activity into an authentic practice intricately woven into organizations' strategic fabric and core values when their cultures purposefully prioritize involvement and cooperation (Vărzaru and Vărzaru, 2015a, 2015b). Perceptions drastically change due to this transformation; CSR no longer serves only as an external duty or public relations gimmick but becomes an essential part of an organization's character. According to Alkhadra et al. (2023), such deep integration improves the institution's reputation and increases staff loyalty and commitment, improving long-term organizational success.

Beyond oversimplified cultural typologies, several other cultural factors significantly improve CSR efforts (Jaakson et al., 2009; Lee and Kim, 2017). This discovery raises important questions about the complex relationship between social responsibility and corporate culture, indicating that several contextual elements probably affect this dynamic interaction (Rotea et al., 2023; Georgescu et al., 2024).

3. Research methodology

Using a quantitative research methodology, our study uses questionnaires to examine the correlations between the variables. Table No. 1 provides a detailed presentation of these research factors.

Table no. 1 Research variables

Type	Code	Variables
Corporate Social Responsibility	CSR1	Environmental Responsibility
	CSR2	Community Involvement
	CSR3	Ethical Business Practices
	CSR4	Employee Wellbeing Initiatives
Organizational corporate	OC1	Innovation Orientation
	OC2	Collaboration and Teamwork
	OC3	Leadership Style
	OC4	Value Alignment

Source: Developed by the authors based on literature review

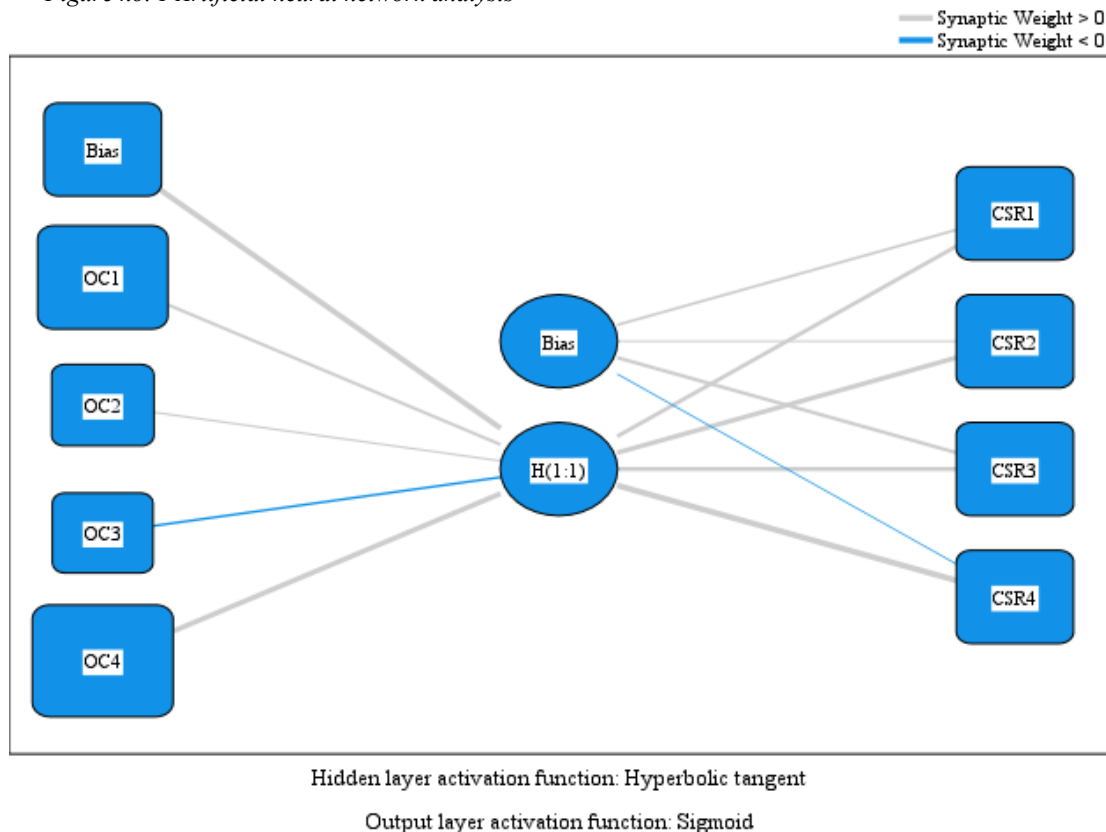
The central hypothesis of our study is that there is a favorable correlation between organizational culture and the application of CSR. This theory aligns with our knowledge that clearly stated organizational cultures, irrespective of their perceived "strength," foster circumstances conducive to creating and applying successful social responsibility plans.

The validity of this hypothesis was examined through the use of structural neural network analysis, following a methodology similar to that applied by other scholars (Vărzaru and Vărzaru, 2016; Nicolescu and Vărzaru, 2020; Vărzaru, 2024).

4. Results and discussions

We can draw several insightful conclusions regarding the relationship between organizational culture and CSR based on the data obtained through artificial neural network analysis. The model incorporated variables grouped under two main dimensions: CSR and Organizational Culture. In investigating the relationship between these constructs, particular attention was directed toward testing the hypothesis that organizational culture positively correlates with CSR. The results support this hypothesis with noteworthy confidence (Figure no.1).

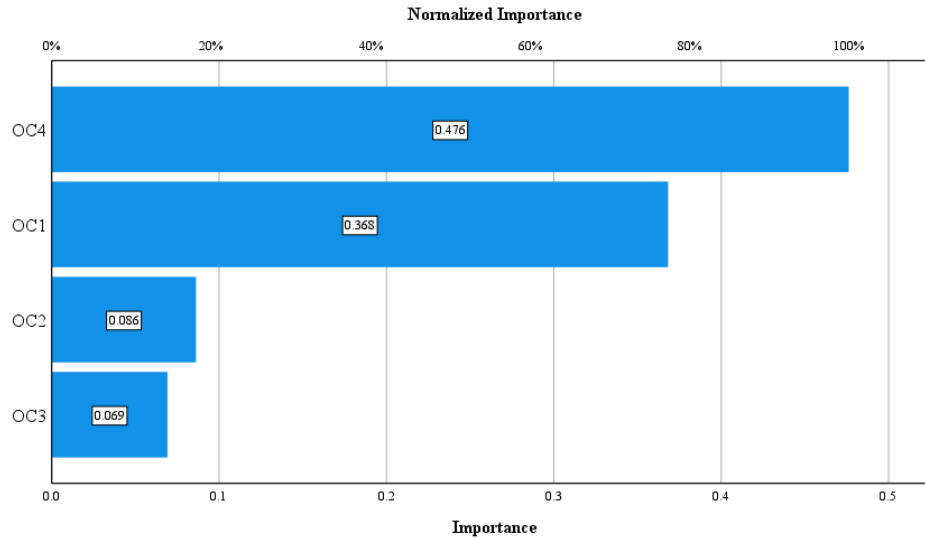
Figure no. 1 Artificial neural network analysis



Source: Developed by the authors based on data using SPSS v 27.0

The parameter estimates from the neural network model highlight a strong influence of certain organizational culture variables on CSR-related outcomes. Value Alignment (OC4) emerged as the most significant predictor, showing the highest normalized importance at 100%. This suggests that when organizational values are aligned and communicated across all levels of the organization, they significantly enhance the implementation and integration of CSR practices. Innovation Orientation (OC1) followed closely in importance, with a normalized value of 77.3%, indicating that a culture that embraces innovation tends to promote socially responsible behavior, possibly by encouraging sustainable solutions and forward-thinking approaches (Figure no. 2).

Figure no. 2 Absolute importance



Source: Developed by the authors based on data using SPSS v 27.0

In contrast, Collaboration and Teamwork (OC2) and Leadership Style (OC3) showed considerably lower importance, with normalized scores of 18.1% and 14.5%, respectively. While still relevant, these variables appear to play a more secondary role in driving CSR outcomes than value alignment and innovation orientation.

Further insights arise from the weight distribution within the hidden layer of the neural network (Table no. 2).

Table no. 2 Model parameters

Predicted		Hidden Layer 1	Output Layer			
		H(1:1)	CSR1	CSR2	CSR3	CSR4
Input Layer	(Bias)	1.231				
	OC1	0.589				
	OC2	0.220				
	OC3	-0.230				
	OC4	1.065				
Hidden Layer 1	(Bias)		0.322	0.137	0.696	-0.126
	H(1:1)		0.827	1.062	0.852	1.242

Source: Developed by the authors based on data using SPSS v 27.0

The connection weights suggest that the internal structure of the model places substantial emphasis on the pathway linking OC4 and CSR dimensions, reinforcing the earlier interpretation regarding its central role. The favorable weight of 1.065 for OC4 in the hidden layer indicates a strong positive effect, which is further amplified through the hidden node outputs to CSR dimensions such as Community Involvement, Ethical Practices, and Employee Wellbeing. Similarly, OC1 shows a moderate but positive influence, whereas OC3 carries a slight negative weight (-0.230), which may reflect inconsistent leadership practices that do not necessarily foster socially responsible initiatives.

The analysis supports the hypothesis that organizational culture positively influences CSR, particularly when that culture is rooted in shared values and innovation. The findings underscore that CSR is not an isolated function but deeply embedded within the broader organizational context. Companies that succeed in cultivating value-driven and forward-thinking cultures are better positioned to implement effective and meaningful CSR strategies.

This evidence validates the original hypothesis and highlights areas within organizational culture that merit greater attention from researchers and practitioners aiming to strengthen CSR initiatives.

5. Conclusions

This study set out to examine the influence of organizational culture on CSR, guided by the hypothesis that a well-defined internal culture fosters the development and implementation of meaningful CSR practices. The findings support this assumption robustly, revealing that organizational culture is not merely a contextual backdrop but an active driver in shaping how CSR is perceived and enacted within organizations.

Value alignment emerged as the most influential factor among the cultural dimensions explored. Organizations, where internal values are clearly articulated, shared, and consistently practiced, tend to display more substantial commitments to CSR. This suggests that when people within an organization feel connected to a common purpose, they are more likely to engage in socially responsible behaviors. Innovation orientation also played a significant role, indicating that cultures encouraging experimentation, adaptability, and forward-thinking tend to be more proactive in adopting sustainable and socially conscious initiatives.

Conversely, while still relevant, leadership style and collaboration demonstrated a less pronounced impact in the model. This does not imply that these elements lack importance but that their influence on CSR may depend on the context in which they are practiced or how they interact with other cultural variables. For example, leadership that lacks consistency or clarity in supporting CSR may inadvertently weaken its integration despite a culture of collaboration being present.

Artificial neural network analysis added depth to the interpretation, allowing for a more nuanced understanding of the nonlinear and complex relationships between cultural elements and CSR outcomes. The model highlighted specific pathways through which culture influences CSR, reinforcing that CSR is deeply embedded in the organizational fabric rather than a set of isolated activities imposed from the outside.

Ultimately, this research underscores the strategic importance of cultivating an organizational culture that embraces shared values and encourages innovation for social impact. Companies seeking to strengthen their CSR performance would benefit from investing in cultural development initiatives that align internal behaviors with broader social and environmental goals.

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Beauty Influencers on Social Media: How They Shape Consumer Emotions And Brand Loyalty in the Cosmetics Industry

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Abstract

Nowadays, beauty influencers are more than content creators; they influence how people feel, think, and choose products. This study looks at how consumers view the authenticity of beauty influencers, the emotions their content brings up, and how these experiences affect brand loyalty. It also looks at how people tell the difference between a genuine recommendation and a post that feels purely commercial.

To better understand these dynamics, we conducted in-depth interviews with 15 women aged between 20 and 40, all active on social media and engaged with beauty-related content. The findings show that authenticity is key to building trust.

The study brings fresh insights into the emotional side of influencer marketing in the beauty industry and highlights the importance of staying genuine, consistent, and emotionally in tune with the audience.

Key words: beauty influencers, authenticity, emotional engagement, brand loyalty, social media marketing

J.E.L. classification: M31, M37, D91, L66

1. Introduction

In 2025, social networks will be part of most people's daily routines, influencing how we communicate, how we get information, or how we choose the products we use. According to data provided by Demandsage (2025), over 5.24 billion people worldwide are actively using social media, meaning approximately 64% of the global population. More than 94% of internet users are on at least one social network. On average, people spend 2 hours and 21 minutes daily on these networks. They interact with about seven different platforms every month. Despite all this, Facebook remains the global leader, with over 3.07 billion users, closely followed by YouTube, Instagram, and WhatsApp - all with over two billion users.

According to the (Datareportal, 2025), in Romania, at the beginning of 2025, 94% of Romanians had access to the internet. Of these, approximately 13 million were active on social networks. More than 75% of people over 18 use at least one social platform, making social media a primary channel for communication, promotion, and influence. Facebook is the most popular platform in Romania for sharing information and entertainment. It is also the top choice for marketing campaigns.

Influencers play an important role online. They can change how people think and what they buy. Their messages can influence opinions, stir emotions, and impact purchasing decisions. Recent research highlights that the perceived authenticity of influencers (Audrezet et al, 2020, p.560) and the emotional reactions of the audience (Casaló et al, 2020, p.511) are essential factors in the effectiveness of social media promotion campaigns.

This paper investigates how consumers view beauty influencers and their authenticity. It focuses on the emotions that their posts create and how these interactions affect loyalty to the brands they promote. The research will use in-depth interviews to gather insights. At the same time, the research aims to understand how people differentiate between a sincere recommendation and one that seems strictly commercial. This paper uses a simple approach to help us understand a complex digital trend that is constantly changing. This trend has a direct impact on modern marketing and how consumers behave.

2. Literature review

The relationship between consumers and social media influencers has become a topic of significant interest in the digital marketing literature. Studies over the past decade have highlighted that influencers are no longer perceived as mere promoters but as "trusted individuals" who influence behaviors, attitudes, and choices (Freberg et al, 2011, p.91; Djafarova et al, 2017).

One of the central concepts in this direction is perceived authenticity, defined as the degree to which the audience feels that an influencer is sincere, transparent, and consistent in their messages (Audrezet et al, 2020, p.560). Authenticity contributes to the formation of a sense of closeness, which can generate trust and, ultimately, loyalty towards the promoted brands (Jin et al, 2019).

The emotions generated by influencer content also play an important role in shaping consumer behavior. Studies show that posts that trigger positive emotions (such as admiration, inspiration, or empathy) are more effective in attracting attention and determining concrete purchasing actions (Casaló et al, 2020, p.512). At the same time, content that provokes social comparisons or frustrations can lead to distancing and distrust (Chae, 2018, p.250).

The specialized literature also draws attention to the risk of superficial promotion, perceived as inauthentic, which can negatively affect both the image of the influencer and the associated brand (de Veirman et al, 2020, p.96). In this context, consumers are becoming increasingly attentive to details such as tone of voice, congruence between the influencer's style and the promoted product, or the frequency of brand changes.

These theoretical directions underlie the present research, which aims to investigate, in a qualitative manner, how authenticity is constructed in the public's perception, what role emotions play in the relationship with influencers, and how brand loyalty is formed or broken in this context.

2.1. Perceived authenticity in influencer marketing

An influencer is a person who can influence the opinions, behaviors, or choices of others, primarily through social media. Influencers are now considered modern opinion leaders who combine their personal lives, stories from their experiences, and collaborations with brands to promote products in an authentic and relatable way (Wang et al, 2021, p.15).

Influencers can be classified in several ways depending on their field of operation and the number of followers they have. They are divided according to the niche they address - such as beauty, fashion, food, fitness, or tech. From a quantitative point of view, Moburst (2025) proposes the following division: nano-influencers (under 10,000 followers); micro-influencers (between 10,000 and 100,000); macro-influencers (between 100,000 and 1 million); mega-influencers/celebrities (over 1 million followers). A distinction is also made between content creators who generate original posts (photos, videos, reviews, etc.) and those who would rather have the role of ambassadors or models for the products of an already known brand.

Even though influencers with a large audience have increased visibility, studies show that those with smaller communities - such as nano or micro-influencers - enjoy more trust and a closer connection with their followers. Thus, in many cases, they can more effectively influence consumer choices, especially among niche audiences (De Veirman et al, 2017, p.800). Therefore, when we talk about influencers, it is not only the numbers or the visual appearance that matters, but mainly how they communicate, how sincere they seem, and what emotional relationship they build with their audience.

Perceived authenticity is one of the most discussed concepts in influencer marketing. It refers to the extent to which the audience feels that an influencer is honest, transparent, and consistent in communicating with their followers (Glucksman, 2017, p.78). In a digital space saturated with sponsored content, authenticity becomes essential in forming a trusting relationship between influencer and consumer. Consistency in communication, congruence between the influencer's style and the promoted products, but also assuming vulnerability or expressing personal opinions contribute to this perception of authenticity (Marwick et al, 2011, p.140).

Authenticity plays a key role in how consumers behave. Studies show that when people view a brand as authentic, they are more likely to buy from and stay loyal to it (Lou et al, 2019, p.60). On the other hand, if a brand lacks authenticity, it can raise doubts and lead consumers to distance themselves or even stop using the product or following the influencer. Especially in the cosmetics field, where trust plays a significant role, authenticity becomes a key differentiator.

2.2. Emotional engagement and consumer reactions to beauty content

The content generated by beauty influencers is not only informative but also has a strong emotional impact. Emotions influence how the audience receives messages and how memorable or compelling a specific content is. Posts that trigger positive emotions such as admiration, empathy, or joy are more likely to attract attention and determine purchasing actions.

At the same time, idealized posts - in which perfectly edited images, expensive products, and "flawless" skincare routines appear - can generate negative emotional reactions. The feeling of comparison, frustration, or pressure to achieve a certain aesthetic standard can lead to distance from the influencer or a negative perception of the product (Kleemans et al, 2018, p.95). Such emotions often appear in content that does not seem realistic or accessible, especially if followers no longer find themselves in the lifestyle.

Another important aspect is related to storytelling - the ability of influencers to tell personal stories or share authentic experiences with products. Gretzel (2017, p.150) emphasizes that storytelling humanizes the content and creates a deeper emotional connection between the audience and the influencer. When people feel that the influencer is "living" the experience, not just promoting it, they are more willing to trust the recommendation.

In addition, recent studies show that emotional involvement is essential in forming loyalty to a brand. Strong emotions (positive or negative) influence immediate reactions and determine whether a consumer returns to that product. Authentic and emotional content thus becomes a key strategy in digital marketing, especially in industries such as beauty, where the visual and symbolic impact is powerful.

In conclusion, emotions are central to how consumers perceive and react to beauty content. It is not just about how a product looks, but how it makes the viewer feel.

2.3. Brand loyalty and consumer trust in influencer contexts

In an increasingly crowded digital landscape, where consumers are exposed to hundreds of advertising messages daily, brand loyalty is becoming increasingly difficult to maintain. That is why the relationship between the brand, the influencer, and their audience plays a key role in building trust and long-term attachment. An influencer perceived as authentic, consistent, and transparent can strengthen a brand's image and significantly contribute to forming a community of loyal consumers (Schouten et al, 2020, p.210).

Audiences react positively when there is a precise fit between the brand's values and the influencer's personal style. For example, an influencer known for promoting a healthy lifestyle will be perceived as more credible when recommending natural or sustainable cosmetic products. On the other hand, collaborations that seem "forced" or involve frequent brand changes can lead to a loss of trust (Boerman et al, 2017, p.85).

Today, consumers want clear communication about sponsorships. If influencers promote products without being honest or just for money, they risk facing negative comments, losing engagement, or even having followers leave. Trust comes not only from the message but also from how consistently influencers behave over time.

On the other hand, when consumers observe an authentic relationship between the influencer and the promoted product - that is, actual use of that product, mentioning personal experiences, and maintaining a sincere tone - brand loyalty is more likely to form and be maintained. This type of relationship is based on an emotional connection and the perception that the influencer is acting in the interest of his or her community, not just commercial collaborations.

In summary, online brand loyalty is built not just through seeing a brand repeatedly, but mainly through trust, transparency, and authenticity. Influencers who can mix these qualities become more than just promoters - they connect the brand with the consumer.

3. Research methodology

The present research was conducted using in-depth interviews. The reason for choosing this method was the desire to find out and better understand how consumers perceive the way beauty influencers present or promote different products, as well as to identify the emotions that are triggered by their posts and how these interactions influence loyalty towards certain brands or even the decision to purchase certain products or not. Another reason for conducting such research was that this method is suitable for exploring topics related to emotions, perceptions, and personal experiences.

In-depth interviews (Boyce et al, 2006, p.3) are a qualitative method that helps researchers gather rich, personal insights. The research process followed several essential steps:

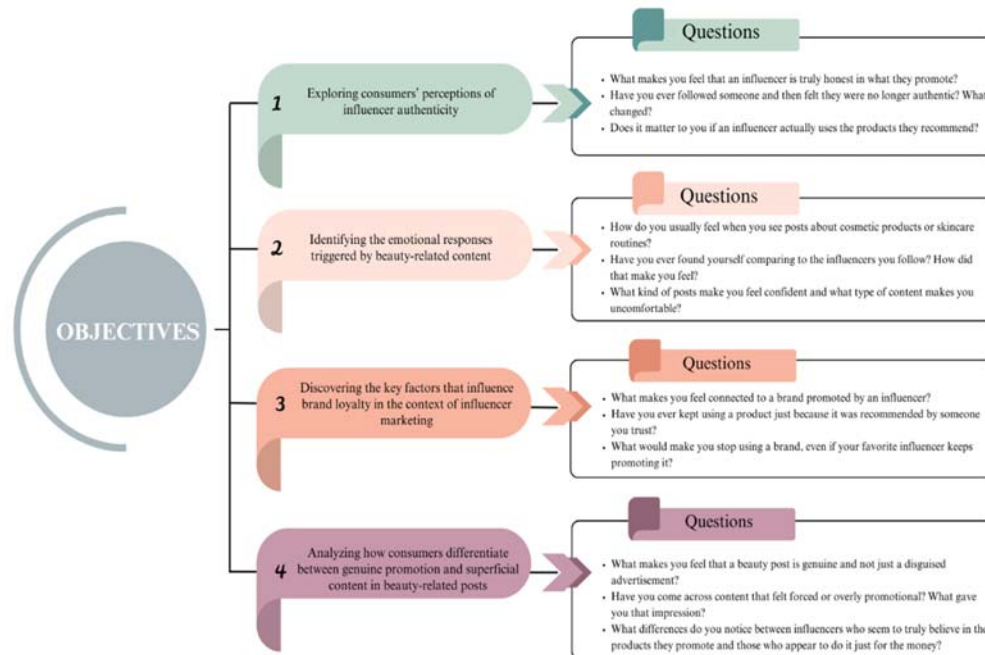
- Defining the research scope and objectives included understanding consumer perceptions of influencer authenticity, identifying emotional responses to beauty-related content, analyzing loyalty mechanisms toward promoted brands, and detecting how consumers distinguish genuine sustainability from superficial content;
- Developing a tailored interview guide structured around the four main research objectives and composed of open questions to elicit personal reflections, attitudes, and behavioral responses;
- Participant recruitment focuses on individuals who are active social media users and frequent followers of beauty influencers.

The study was conducted using the Zoom platform and took place in March 2025.

In this research, 15 women from Brasov, Romania, aged between 20 and 40, interested in the beauty field, women who usually use cosmetic products, who are active on social networks (especially on Instagram and TikTok), and who are familiar with online content, especially that posted by influencers, were interviewed. The participants were selected using the snowball method. The interviews lasted between 30 and 45 minutes, and the responses provided by the participants were transcribed and coded manually in order to preserve the accuracy of the information provided by the respondents. All ethical standards were rigorously upheld.

The research aimed to achieve the objectives shown in Figure 1.

Figure no. 1. Objectives of the research



Source: Authors' own research

O1: Exploring consumers' perceptions of influencer authenticity

This objective aims to understand how consumers form their opinions about beauty influencers' sincerity when presenting or promoting specific products. First of all, we want to find out what aspects convey to people that an influencer is honest and uses the promoted products, but also to identify those elements that give them the feeling that the content is made only with the aim of selling. Through the responses obtained from the participants, we can better understand how trust in such recommendations is built (or lost).

O2: Identifying the emotional responses triggered by beauty-related content

This objective aims to identify consumers' emotions when they watch posts about beauty products or care routines. While some posts may inspire trust, admiration, or curiosity, others may lead to comparisons, pressure, or frustration. We want to understand how these states influence relationships with influencers, self-image, and even purchasing decisions.

O3: Discovering the key factors that influence brand loyalty in the context of influencer marketing

The objective focuses on identifying the reasons why a consumer becomes loyal to a brand presented by an influencer. We try to find out how much trust in that influencer matters, how much it influences personal experience with the product, and what determines people to continue or stop buying that product. We also want to see if an influencer's support of a brand can maintain loyalty even when dissatisfaction arises.

O4: Analyzing how consumers differentiate between genuine promotion and superficial content in beauty-related posts

This objective aims to discover how people differentiate between a sincere post, in which the influencer believes in the promoted product and uses it regularly, and one that seems to be made only to honor a collaboration/contract with the company in question. We are interested in discovering what aspects inspire authenticity in them and what gives them the impression that a post is fake, forced, or lacking accurate content. Understanding these perceptions is important for assessing the credibility of beauty content.

As previously mentioned, to achieve these objectives, we considered several essential steps: research planning, participant selection, data collection, data analysis, and interpretation of the results. In the preparation stage, we established the research questions and formulated the interview guide based on the proposed objectives. We also have stability in the selection criteria of participants,

choosing people active in the online environment who follow influencers and consume beauty content.

The interviews conducted in the online environment were guided by open-ended questions designed to encourage natural discussions based on each person's personal experiences. No predetermined answer options were offered, precisely to avoid influencing opinions and to surprise the answers. The data were analyzed using the thematic analysis method. We aimed to identify recurring themes and response patterns that are related to the research objectives. This allowed us to extract relevant insights and better understand how consumers think about influencers and the brands they promote. Throughout the research, we respected ethical norms: we obtained informed consent from all participants, guaranteed confidentiality and anonymity, and treated all information responsibly. Finally, we interpreted the importance of the proposed objectives and formulated conclusions that reflect most of the ideas in this qualitative research.

4. Results and discussion

To better understand how consumers relate to beauty influencers and the content they create, we analyzed the responses provided by the participants, based on the four objectives established in the research. As can be seen from Figure no. 1, each objective followed a specific direction and included three questions. The responses provided by the participants outlined an overview of consumer perception in the current context of the online promotion of beauty products through influencers.

The main ideas and themes of each objective are identified, along with the relevant interpretations extracted from the participants' responses.

These results give us a clearer perspective on how the young female audience, active in the digital environment, forms its opinions and choices related to cosmetic products and brands promoted through influencers.

O1: Exploring consumers' perceptions of influencer authenticity

Interview participants frequently mentioned that they can easily sense when an influencer is being sincere in what they are promoting. The most frequently cited criteria were using the product in everyday life (not just in campaigns), consistency in recommendations, and a natural style of talking about the product. For example, one respondent said that "you can tell when she is speaking from her own experience, she has a different tone, she is more relaxed."

On the other hand, the signs that made them believe that a post was just an advertisement were forced language, excessive use of superlatives, lack of personal details about the product, and the constant presence of the hashtag #ad without any other context. Participants were attentive to the connection between the influencer's image and the promoted product – when they felt that the two did not match, they lost trust.

These perceptions validate the conclusions of other studies that show that perceived authenticity is an essential factor in message acceptance and brand loyalty formation. In an online environment saturated with sponsored content, authenticity seems to be the main aspect that consumers look for when perusing an influencer's advertising and even trying to make a connection between that influencer and their audience.

O2: Identifying the emotional responses triggered by beauty-related content

Participants admitted that influencer posts frequently provoked a variety of emotions. The most common were admiration (for appearance, lifestyle, or skin "glow"), but also comparison and sometimes frustration ("I look at it and think that I will never look like that..."). Positive emotions were more common in the case of influencers who seemed real, natural, and who also talked about imperfections or failures.

Conversely, when the content was perceived as "too filtered", with too much perfection displayed, many respondents said they felt lied to. Some of the participants also mentioned that they avoided the content of some influencers because their self-confidence was affected.

This emotional tension is confirmed by the specialized literature, which shows that social media directly influences self-esteem and body perception, especially among young women. Emotions thus become an important filter through which consumers decide whether to stay connected or distance themselves from a particular influencer.

O3: Discovering the key factors that influence brand loyalty in the context of influencer marketing

During the interviews, it became clear that trust in the influencer is a significant factor in brand loyalty. Many respondents confessed that they started using certain products only because they saw them recommended by a person they trusted, and later, they remained loyal because the product confirmed their expectations.

At the same time, if the promoted product did not correspond to reality or if the influencer frequently changed the promoted brands, trust and loyalty quickly decreased. Some participants mentioned that their loyalty is maintained only as long as the influencer is consistent and sincere.

The observations correspond to theories about consumer loyalty in the digital context, where the emotional component (trust, identification with the influencer) is at least as important as the concrete experience with the product. Loyalty is, therefore, a mix between the content consumed and the relationship with the creator of that content.

O4: Analyzing how consumers differentiate between genuine promotion and superficial content in beauty-related posts

Participants were very attentive to the tone and style of the post to differentiate between a sincere and superficial recommendation. They said that sincere posts seem more relaxed, contain personal details ("I used it in the morning with X cream, I like that it does not leave a greasy film") and do not insist too much on "buy now."

In contrast, posts that seemed to be made "just for collaboration" had, according to the participants, advertising language, too perfect decoration, product promotions that did not fit with the rest of the influencer's content and a lack of any real experience with that product. One respondent said: "You can tell when it is forced. Especially when yesterday he had another favorite cream and today he says another is the best."

These insights align with research showing that the public is becoming increasingly sensitive to "ad fatigue" and the lack of coherence in influencer discourse. To be credible, promotional content must be aligned with the influencer's identity and convey an authentic experience.

The results of the qualitative research confirm that the relationship between consumers and beauty influencers is a complex one, built on perceptions of authenticity, personal emotions and trust in the recommendations made. The interviewed participants demonstrated a fine ability to distinguish between sincere promotions and those made strictly for commercial purposes, paying attention to details such as the tone of the post, the connection between the brand and the influencer, but also the presence of an authentic experience with the promoted product. Emotions played an essential role in this process, influencing both self-image and attitudes towards the product or brand.

Also, loyalty to a brand is not determined exclusively by the quality of the product, but also by trust in the person who recommends it. Trust and the perception of authenticity prove to be key factors in forming a lasting attachment to brands promoted through influencer marketing. Thus, this research highlights the importance of honest and coherent communication from influencers and makes a valuable contribution to understanding how beauty content is received and evaluated by the active female audience online.

5. Conclusions

This research provides valuable insight into how online consumers perceive the authenticity of beauty influencers, as well as how they emotionally react to their content and develop (or not) loyalty to the brands promoted.

The results confirm that the relationship between the consumer and the influencer is deeply emotional, being influenced by factors such as tone of voice, naturalness of speech, coherence in communication and the connection between the influencer's style and the products presented. In addition, it has been observed that the public is increasingly aware of the difference between a sincere recommendation and a superficial promotion based exclusively on commercial collaborations.

This research complements other studies that highlight the fact that perceived authenticity is an essential element in influencer marketing, influencing not only trust in the person (influencer) but also the attitude toward the brand (Audrezet et al, 2020, p.560; Djafarova et al, 2017, p.2). Moreover, the emotions that online beauty content generates in consumers contribute significantly to the way they relate to their own image, as well as to the way they make purchasing decisions. Therefore, we

can conclude that the influence of influencers can no longer be viewed as strictly functional but rather affective and symbolic.

However, qualitative research based on in-depth interviews cannot generalize the results to the population level. The relatively small sample of 15 participants allows for a detailed, but not exhaustive, understanding of the phenomenon analyzed. Also, the answers can be influenced by factors such as the participant's context or even the desire to provide socially accepted answers.

Even so, the results provide solid starting points for future, larger-scale research that could validate these findings on larger samples or through mixed methods. In an increasingly competitive digital landscape, understanding how authenticity, emotions, and influencer marketing intersect with consumer choices is becoming essential for both brands and content creators.

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Sustainable Leadership – Skills and Strategies for Responsible Management

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Abstract

In the current context of digital transformation and the challenges posed by the knowledge-based economy, sustainable leadership has become an essential component of responsible management. Based on a solid theoretical foundation, which addresses concepts such as digital leadership, employee involvement, and the specifics of organizations in the knowledge economy, the study explores relevant explanatory models and identifies mediating and moderating factors of the analyzed relationship.

The research is based on statistical methods to analyze data collected from a sample selected based on rigorous criteria. The results obtained highlight a significant correlation between digital leadership styles and employee engagement levels, while also emphasizing the role of contextual variables in strengthening this relationship. The article thus contributes both theoretically, to strengthening the conceptual framework regarding sustainable leadership, and practically, by offering relevant recommendations for leaders concerned with sustainable and responsible development.

Key words: sustainable leadership, knowledge-based economy, responsible management, digital transformation, leadership practices

J.E.L. classification: D83, L21, M12, M14, O15, Q01

1. Introduction

In the current context of digitalization, in the rapid pace of change, digital leadership has become an essential factor in organizational success. The knowledge-based economy requires leaders to develop their digital skills, encourage innovation, and maintain a work environment that supports employee involvement (Avolio, Kahai and Dodge, 2001, p. 615). Digital transformation doesn't have to represent just a technology change, but also a managerial one, affecting organizational culture, business models, and work structures (Westerman, Bonnet and McAfee, 2014, p. 37).

Employee engagement is a key element of organizational performance, having a direct impact on productivity and maintenance/retention personnel (Saks, 2006, p. 602). In knowledge-based organizations, where intellectual capital represents the main strategic resource, employee involvement is influenced by the leadership style practiced by managers (Yukl, 2013, p. 249). Digital leadership, characterized by flexibility, uses technology in making decisions and encouraging remote work, and plays an essential role in maintaining a motivated and engaged workforce that reaches objectives (Northouse, 2021, p. 315).

The main purpose of this study is to analyze the relationship between digital leadership and employee engagement in knowledge-based organizations. In a dynamic and globalized business environment, leaders must adopt new technologies and manage geographically distributed teams while maintaining a high level of employee engagement (Bass and Avolio, 1994, p. 194).

The specific objectives of the research include:

- Identification features of digital leadership and the impact on employees
- Analysis of how digital leadership influences the motivation and professional satisfaction of employees
- Analysis of the differences between digital leadership styles and their effects on performance
- The proposal of certain managerial strategies to increase employee involvement in the knowledge economy.

Thus, the proposed research aims to answer a series of questions, such as:

1. What are the main characteristics of digital leadership, and how do they influence employee engagement?
2. Is there a significant correlation between digital leadership and the level of employee motivation and satisfaction?
3. How does digital leadership influence the collaboration and performance of virtual teams?

Based on a review of specialized literature, we can formulate the following hypotheses:

- H1: Digital leadership has a positive effect on employee engagement in knowledge-based organizations
- H2: Effective use of technology in team management influences positive professional satisfaction
- H3: There is a mediating relationship between digital leadership, organizational culture, and involvement of employees

2. Theoretical background

The theoretical models explain the relationship between digital leadership and employee involvement by analyzing the main theoretical concepts: notional advanced, economy, knowledge-based, digital leadership, and motivation of employees.

Digital leadership is a leadership style that uses technology to improve decision-making, foster collaboration, and support innovation in a business environment characterized by accelerated digitalization (Avolio, et al., 2014, p. 744). According to Northouse (2021, p. 320), digital leadership involves developing essential digital skills for managing virtual teams and facilitating interaction between employees through technological platforms.

An expanded definition is provided by Kane et al. (2019, p. 67), who emphasize that a digital leader is not just a user of technology but an agent of change who promotes digital culture and creates an environment conducive to innovation. In this sense, digital leadership is considered an essential factor in increasing the competitiveness of knowledge-based organizations (Westerman, Bonnet and McAfee, 2014, p. 41).

Employee engagement is defined as their level of enthusiasm, dedication, and emotional connection to the organization and their professional activities (Saks, 2006, p. 602). Involving employees has three main benefits:

- cognitive involvement, which reflects the degree to which employees are focused and motivated in their work (Schaufeli, Bakker and Salanova, 2006, p. 715);
- emotional involvement, which includes the employee's loyalty and attachment to the organization (Kahn, 1990, p. 694);
- behavioral involvement, which refers to the level of extra effort that the employee is willing to make for the success of the organization (Rich, Lepine and Crawford, 2010, p. 617).

The determinants of employee engagement include leadership style, organizational culture, performance recognition, and professional development opportunities (Bakker and Demerouti, 2008, p. 212). Digital leadership can have a significant impact on employee engagement, as technology facilitates better communication, collaboration, and autonomy at work (Hendrickson et al., 2020, p. 155).

Knowledge-based economy is an economic model in which innovation, technology, and intellectual capital are the main sources of value and competitive advantage (Powell and Snellman, 2004, p. 201). It is characterized by:

- Technology dependence – organizations must adopt digital solutions to remain competitive (Nonaka and Takeuchi, 1995, p. 89).
- Importance of human capital – Humans are essential for INNOVATION and organizational success (Drucker, 1993, p. 12).
- dynamism and volatility – fast changes in the economy require adaptability and agility in organizations (Brynjolfsson and McAfee, 2014, p. 55).

One of the main challenges of the knowledge-based economy is managing the workforce in a digitalized environment. Leaders must create a culture of continuous learning among human resources and ensure employee engagement, even in remote work contexts (Davenport and Prusak, 1998, p. 136).

There are many theoretical models that can explain the relationship between digital leadership and employee engagement. Among the many Helpful models are listed:

a) Transformational Leadership Theory (Bass, 1985). Digital leadership shares many characteristics of transformational leadership, as it involves vision, innovation, and the ability to motivate employees to embrace change (Bass and Avolio, 1994, p. 198). Digital leaders can use technology to inspire employees and increase their level of engagement through effective communication and performance recognition.

b) The Job Demands-Resources (JD-R) model (Bakker and Demerouti, 2007). This model assumes that resources and Organizational factors, such as technology and managerial support, contribute to increasing employee engagement. Digital leadership can reduce stressful working conditions and can offer us human resources advancements such as enhanced autonomy and professional development opportunities (Schaufeli and Taris, 2014, p. 49).

c) Leader-member exchange (LMX) theory (Graen and Uhl-Bien, 1995). This theory suggests that the quality of the leader-employee relationship can directly influence engagement in reaching objectives. In a digital environment, constant interaction through technological platforms can strengthen trusting relationships and increase employee engagement (Erdogan and Bauer, 2015, p. 103).

3. Research methodology

Research pursues an empirical approach by combining quantitative and qualitative methods to get an understanding of the phenomenon studied. The research model is an explanatory and correlational type, aiming to identify causal relationships between digital leadership and employee engagement. In this context, the research will use a cross-sectional design to collect data from a relevant sample of employees in knowledge-based organizations.

According to Bryman (2015, p. 78), the cross-sectional design is suitable for studies that analyze relationships between variables at a specific point in time. The choice of an explanatory design is justified by the need to understand the mechanisms by which digital leadership influences employee engagement, using already validated theoretical models (Bakker and Demerouti, 2007, p. 313). Thus, the hypotheses formulated in the previous chapter will be tested through rigorous statistical methods, using regression models and mediator analysis to highlight the factors that influence the relationship between digital leadership and employee engagement.

In our research, to ensure the validity and reliability of the analyzed data, we will use a combination of quantitative and qualitative methods, including standardized questionnaires and semi-structured interviews.

- a) A standardized questionnaire, which will include sections relating to:
- demographic features (age, gender, position in organization, etc.)
 - Digital leadership – measured by the E-Leadership Scale (Van Wart et al., 2017, p. 456)
 - Employee engagement level – evaluated by Utrecht Work Engagement Scale (Schaufeli and Bakker, 2003, p. 25)
 - mediators and moderators – includes factors such as employee autonomy, digital organizational culture, and the level of digitalization of the organization

b) Semi-structured interviews with leaders and employees from participating companies with the aim of getting a deeper understanding of the digital leadership impact on employees. The questions are built based on specialized literature and aim at:

- Leader perception on the importance of digital competencies in leadership teams
- How digitalization influences collaboration and communication in a team
- Factors that contribute to the growth or decrease of employee engagement in a digitized environment

The data obtained from the interviews are analyzed thematically to identify significant patterns and relationships, according to the method proposed by Braun & Clarke (2006, p. 83).

Data collection will be analyzed using the SPSS and AMOS statistical packages, applying the following techniques:

a) Descriptive analysis – is used to examine distribution and to identify any extreme values or anomalies (Field, 2013, p. 145)

b) Correlational analysis - The Pearson Correlation will be used to measure the relationship between digital leadership and employee engagement (Hair et al., 2010, p. 211)

c) Multiple linear regression - will be applied to determine the extent to which digital leadership predicts employee engagement, controlling for demographic and contextual variables (Cohen, Cohen, West and Aiken, 2013, p. 92)

d) Mediator and moderator analysis

e) Mediation analysis (Baron & Kenny, 1986, p. 1173) will be used to test whether variables such as digital organizational culture mediate the relationship between digital leadership and the involvement of employees.

f) Moderator analysis (Hayes, 2017, p. 289) will examine whether the effect of digital leadership is stronger in certain contexts, for example, in organizations with a high degree of digital transformation.

The study sample includes 300 employees and 50 leaders from knowledge-based organizations, selected through a combination of stratified and convenience sampling (Etikan, Musa and Alkassim, 2016, p. 3).

The criteria for inclusion in the sample are:

1. Active employees in organizations with a high degree of digitalization
2. leaders with at least two years of experience managing digital teams
3. companies in knowledge-based sectors, such as IT, education, consulting, and research and development.

The exclusion criteria are:

- employees from traditional organizations, with a low degree of digitalization
- leaders without managerial experience in the digital environment
- respondents who do not fully complete the questionnaire.

The sample size is determined using the G. Power method to ensure adequate statistical power (Faul et al., 2009, p. 179). With an effect size average ($f^2 = 0.15$) and a test power of 0.80, a minimum of 200 respondents is required for the regression analysis, which justifies choosing a larger sample.

4. Results and discussions

The interpretation of results will start with a descriptive analysis of the variables, continuing then with the examination of the relationship between digital leadership and employee engagement, and finally, with the identification of mediating and moderating factors. Discussions will be focused on analyzing implications in managerial practice, highlighting recommendations for improving digital leadership in knowledge-based organizations.

Before testing the research hypotheses, we conducted a descriptive analysis of the variables, including mean, standard deviation, skewness, and kurtosis. Table 1 presents Descriptive results for the main variables studied:

Table no. 1: Descriptive values results

Variable	Mean	Standard deviation	Asymmetry	Kurtosis
Digital leadership	4.21	0.76	-0.43	-0.12
Involvement employee	3.89	0.81	-0.27	-0.08
Autonomy in work	4.10	0.85	-0.51	-0.18
Organizational culture digital	4.35	0.79	-0.62	-0.21

Source: Own elaboration

The data indicates that respondents perceive digital leadership and the organization's digital culture positively, with high average scores. The variables have a normal distribution (skew and kurtosis fall within the recommended range of ± 1 , according to Hair et al., 2010, p. 213), which allows the use of advanced statistical techniques, such as regression and mediator analysis.

To test H1 ("Digital leadership has a positive effect on employee engagement"), we used multiple linear regressions. The results indicate a significant relationship between digital leadership and employee engagement ($\beta = 0.42$, $p < 0.01$), which confirms our hypothesis.

Correlational analysis shows that digital leadership is positively associated with employee engagement ($r = 0.48$, $p < 0.01$), suggesting that leaders who use digital technologies for communication, collaboration, and motivation manage to maintain a higher level of engagement in their teams. The results confirm the conclusions of previous studies, such as those conducted by Van Wart et al. (2017, p. 458), which emphasize that the use of technology in leadership facilitates transparency, autonomy, and effective interaction among employees.

Factor mediators and relationship moderators were studied.

To explore H2 ("Employees Autonomy mediates the relationship between digital leadership and employee engagement"), we used mediator analysis (Hayes, 2017, p. 310). The results indicate that:

- Digital leadership is positively associated with employee autonomy ($\beta = 0.38$, $p < 0.01$).
- Employee autonomy is positively associated with employee engagement ($\beta = 0.35$, $p < 0.01$).
- After inclusion of autonomy as a mediating variable, the direct effect of digital leadership on engagement decreases ($\beta = 0.26$, $p < 0.05$), indicating a partial mediation effect.

This confirms that digital leadership positively influences employee engagement by increasing their level of autonomy, which is consistent with self-determination theory (Deci and Ryan, 2000, p. 233).

With regard to H3 ("A digital organizational culture moderates the relationship between digital leadership and employee engagement"), we used a moderator analysis. The results show that the interaction between digital leadership and digital culture is significant ($\beta = 0.29$, $p < 0.01$), indicating that the effect of digital leadership is stronger in organizations with a developed digital culture.

These results support the idea that digital leadership is more effective when implemented in an organizational environment that supports digitalization and innovation (Westerman et al., 2014, p. 46).

The results of this study have important implications for managerial practice, for leaders and organizations that want to improve employee engagement through digital leadership. Among recommendation Key recommendations include:

Communication-based digital leadership style, transparency, and use technology collaborative by using digital platforms (e.g., Slack, Microsoft Teams) for communication and continuous interaction, creating an inclusive digital environment that supports autonomy and innovation.

2. Developing a digital organizational culture to support employee engagement by implementing digital training programs to grow the technological skills of employees, creating policies that encourage the use of technology for collaboration and decision-making.

3. Increasing employee autonomy through digitalization by allowing them to work flexibly and make decisions based on their specific skills, using technology to reduce rigid control and stimulate employee proactivity.

These measures can help improve employee engagement and increase the competitiveness of organizations in the knowledge-based economy.

5. Conclusions and recommendations

This section summarizes the main findings of the study, highlighting the theoretical and practical contributions of research on digital leadership and employee engagement in the knowledge economy. We also discuss the limitations of the study and propose future research directions to deepen this emerging field.

The research investigated the relationship between digital leadership and employee engagement in the knowledge-based economy, exploring the mediating and moderating factors of this relationship.

The empirical analysis led to the following main findings:

1. Digital leadership has a significant positive impact on employee engagement ($\beta = 0.42$, $p < 0.01$), confirming Hypothesis H1. This result shows that leaders who use digital technologies for coordination, communication, and motivation can improve the level of commitment of their team.

2. Employee autonomy mediates the relationship between digital leadership and employee engagement ($\beta = 0.35$, $p < 0.01$), which confirms Hypothesis H2. Digital leadership increases autonomy, giving employees more flexibility and control over their tasks, which leads to greater engagement.

3. Digital organizational culture moderates this relationship, showing that the effect of digital leadership is stronger in companies that have adopted a strong digital culture ($\beta = 0.29$, $p < 0.01$), confirming hypothesis H3. This emphasizes the importance of the organizational environment in the effectiveness of digital leadership.

4. The analysis of semi-structured interviews highlighted that leaders who promote the use of digital technologies and agile practices contribute to greater employee engagement, as they facilitate collaboration and reduce organizational barriers.

These findings are consistent with existing literature (Van Wart et al., 2017; Saks, 2006), reinforcing the idea that digital leadership is a key factor in the success of knowledge-based organizations.

Research may make several important contributions to the specialized literature regarding the correlation between digital leadership and management of employees, through:

- Integration of digital leadership in the Job Demands-Resources (JD-R) model, demonstrating that it functions as a "job resource" that reduces professional stress and grows commitment
- The expansion of the transformational leadership theory (Bass and Avolio, 1994) by highlighting the role of autonomy and digital culture in maximizing the impact leaders have on employees
- Validation of empirical analysis of theoretical models in the context of the knowledge-based economy, supporting the importance of contextual factors in the effectiveness of digital leadership

The results studied offer valuable implications for leaders and organizations looking to improve employee engagement through digital leadership:

1. The adoption of an active digital leadership style – managers need to use technology to maintain open and effective communication with their employees
2. Employee autonomy growth through technology – providing flexibility in making decisions may grow motivation and involvement
3. Investments in a digital organizational culture – companies need to support training leaders in digital skills and create policies that encourage digital innovation
4. Use collaborative platforms – applications like Microsoft Teams, Slack, and Trello can improve work efficiency in virtual teams and contribute to employee engagement.

Although the study provides relevant insights into digital leadership, certain limitations must be considered:

1. Cross-sectional design. Because the data were collected at a single point in time, we cannot establish definitive causal relationships between variables. Research the future. It could use a longitudinal design to examine the long-term effects of digital leadership
2. The sample is limited to certain economies/fields. Most respondents come from fields such as IT, education, and consulting. Extending the research to other sectors, such as manufacturing or healthcare, could provide a more complete picture fill on digital leadership

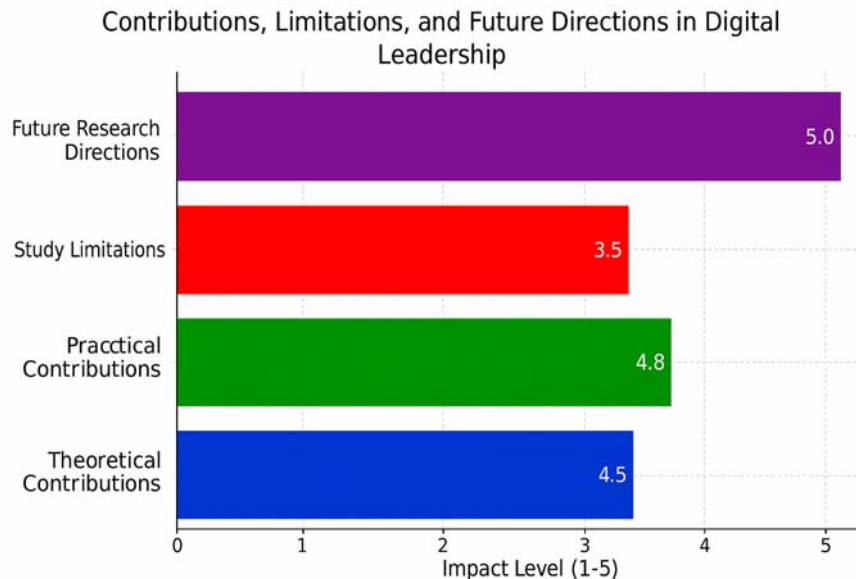
3. Self-assessment as a data collection method. Considering the fact that respondents completed the questionnaires alone, there may be a social desirability bias (Podsakoff et al., 2003). Future studies could use mixed methods, including direct observations and objective data regarding employee performance

4. Cultural and Geographical. Organizational culture digital can vary significantly between regions. Therefore, future research should analyze the impact of digital leadership in various international contexts.

Future research directions, to deepen this field, may target:

- exploring digital leadership in the context of hybrid work by studying how leaders manage mixed teams (physical-virtual)
- analyzing the relationship between digital leadership and organizational innovation by investigating how digital leaders stimulate creativity and the development of new products or services
- Integration of artificial intelligence in digital leadership through impact research using AI for decision making and employee engagement
- comparison of digital leadership with other leadership styles, such as traditional or servant leadership in relation to organizational performance

Figure no. 1



Source: Own elaboration

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The Contribution of Artificial Intelligence in Talent Retention

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Abstract

Human Resource Management (HRM) adapts to new trends in Artificial Intelligence (AI) by integrating it into core activities, with a particular focus on its applicability in talent retention processes (Vrontis, et al., 2020). Through a dual methodological framework combining a bibliometric analysis of 64 scientific articles indexed in the Scopus database (2020-2025) with an empirical study based on a customized questionnaire, the article highlights both the opportunities and barriers encountered in the adoption of AI in HR processes. The bibliometric analysis, conducted using VOSviewer software, reveals a weak conceptual link between AI and talent retention, despite the growing interest in both topics. Empirical data collected from 60 validated responses highlights limited adoption of AI in HRM practices and highlights a lack of strategic implementation. The results highlight the need to develop clear organizational policies, intensify digital literacy efforts among HR professionals and systematically integrate AI into sustainable talent retention strategies.

Key words: talent retention, artificial intelligence, human resource management, organizational strategies, employee engagement

J.E.L. classification: J63, M12, O33, J24

1. Introduction

Human resource turnover is a problem that even the largest companies face.

This problem is based on several factors, including changing employee preferences or their vision of a job. While initially work was a source of income to support oneself and one's family, people soon realized that they wanted to earn more money. They wanted more money to support and satisfy not only their lives and families, but also some of their desires. In the third stage, people realized that, in addition to money, they needed other things: time to spend the money they earned, but also time to spend with their families and loved ones. This is confirmed by studies on Generations Y and Z, which emphasize flexibility, autonomy, and wellbeing (Deloitte, 2025) (Dangmei & Pratap Singh, 2016).

The whole process of social development has led to increased dissatisfaction with available jobs and people changing jobs more and more often in an attempt to find the best job. This dissatisfaction has contributed to an increase in professional mobility, which makes it difficult to retain valuable employees in the long term.

To counteract this trend, organizations have begun to adopt complex strategies aimed at reducing staff turnover (Nawaz, Arunachalam, Pathi, & Gajenderan, 2024). Recent analyses show the effectiveness of competitive compensation packages, flexible work programs, and opportunities for continuous professional development (training, coaching, mentoring) (Yudi Kurniawan & Nurulhuda, 2025). At the same time, technological tools such as HR chatbots, sentiment analysis, and AI programs for wellbeing have gained ground, contributing to a reduction in turnover of up to 20-30% in companies that have implemented them (Mohammad, 2018) (PwC, 2017).

In the process of discovering the most effective strategies, bibliometric studies were conducted in (Săcuiu & Micu, 2024) and (Săcuiu & Micu, 2025) that focused on an extensive analysis of the specialized literature. We found that the use of technology in human resources to reduce staff turnover has been little studied. Based on this gap, we set out to analyze in detail the potential that artificial intelligence can bring to human resource management as a strategic tool for retention.

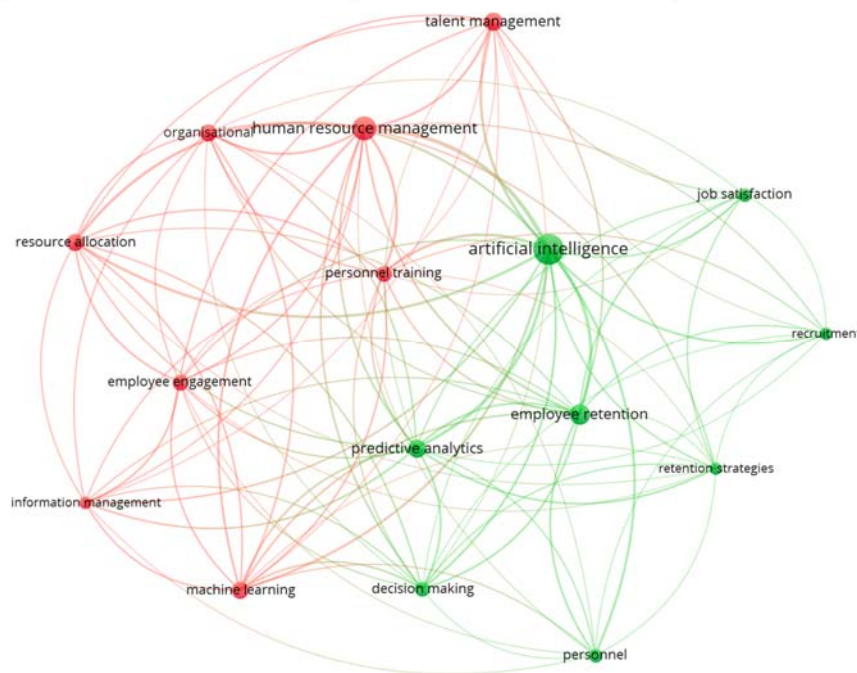
2. Literature review

The use of AI in talent retention must be understood within the broader context of the digital transformation of HR. According to Colbert, Yee, and George (2016), workforce digitization is not only a technological process but also a profound change in organizational culture and leadership model (Colbert, Yee, & George, 2016). In this context, artificial intelligence is seen as a tool for augmenting human capabilities, not as a substitute (Raisch & Krakowski, 2020).

The theoretical foundations of employee retention include Herzberg's motivation theory, social exchange theory (SET), and employee-organization compatibility theory. Herzberg (1959) suggests that satisfaction and motivation result from intrinsic factors such as professional development and recognition (Herzberg, Mausner, & Snyderman, 1959), while SET (Cropanzano & Mitchell, 2005) highlights the importance of reciprocity in work relationships. AI can be seen as a facilitator of these factors by personalizing the employee experience, analyzing feedback, and predicting the risk of turnover. AI can also support employee-role compatibility through matching algorithms in recruitment and tailored career plans. This conceptual framework supports the use of AI not only in transactional functions but also in data-driven retention strategies (Chamorro-Premuzic, Akhtar, Winsborough, & Sherman, 2017).

To understand the current state of knowledge on the integration of AI into talent retention strategies, we performed a bibliometric analysis using VOSviewer on a selection of 64 articles indexed in the Scopus database (Figure 1). These articles, published between 2020 and 2025, were filtered using the keywords "artificial intelligence" and "talent retention." We set a minimum threshold of 5 occurrences for the inclusion of terms in the network, resulting in 16 relevant keywords that were pre-cleaned (Table 1). This approach is aligned with Van Eck & Waltman's recommendations on term co-occurrence analysis (Van Eck & Waltman, 2010).

Figure no. 1. Network vizualization of co-occurrence based on all keywords



Sources: VOSviewer

The analysis identified two main thematic groups. The first group, marked in red, focuses on traditional human resource management topics such as employee engagement, resource allocation, and workforce planning. The second group, marked in green, includes concepts directly related to AI technologies such as machine learning, predictive analytics, and algorithmic recruitment tools. This visible thematic separation suggests a compartmentalized approach to the literature, in which technology and retention are treated in isolation.

Despite the emergence of linking terms such as decision support, digital transformation, and human resources automation, the direct conceptual link between AI and employee retention was particularly weak.

Table 1 shows that the most frequent terms are "artificial intelligence" (31 occurrences, link strength = 101), "HRM" (19, LS = 71), and "employee retention" (13, LS = 52). However, the direct link between these terms is not as strong as the intra-cluster links. For example, "predictive analytics" (11, LS = 51) and "machine learning" (9, LS = 42) form a technological core, while terms such as "personal training" (8, LS = 40), "employee engagement" (8, LS = 32), and "job satisfaction" (6, LS = 16) appear in the traditional retention area.

Table no. 1 Keywords and links

No.	Keyword	Occurences	Total link strength
1	Artificial intelligence	31	101
2	HRM	19	71
3	Employee retention	13	52
4	Predictive analytics	11	51
5	Talent management	11	33
6	Machine learning	9	42
7	Organisational	9	35
8	Resource allocation	10	42
9	Employee engagement	8	32
10	Personnel training	8	40
11	Decision making	7	37
12	Personnel	6	21
13	Job satisfaction	6	16
14	Information management	5	29
15	Strategies retention	5	21
16	Recruitment	5	17

Sources: VOSviewer

This distribution confirms that although AI is frequently mentioned in HRM literature, its specific connection with employee retention is weak and fragmented. Terms such as "retention strategies" (5, LS = 21) or "recruitment" (5, LS = 17) have low frequencies and are located on the periphery of the network. This supports the hypothesis that the application of AI in talent retention is still emerging, being treated on an ad hoc basis rather than integrated into the strategic framework.

While AI is an increasingly discussed tool in the context of recruitment and data-driven decision-making, its strategic application in promoting long-term employee engagement and retention is still underdeveloped (Ransbotham, Kiron, Gerbert, & Reeves, 2017). The present research aims to fill this gap through an empirical analysis of the current level of AI use and its perceived potential within the HR function.

3. Research methodology

For this study, we conducted a survey using the open-source platform LimeSurvey, known for its ability to manage advanced logical branching in questionnaire design. It was distributed to a wide audience in the field of human resources, including managers, specialists, and consultants. The survey reached 112 people via email, social media, and other channels. The total number of respondents was 66, and after data cleaning, 60 valid questionnaires were retained.

The low level of participation in such a study can be considered an indirect indicator of the early stage of AI involvement in human resources management.

The questionnaire was divided into six sections, which included demographic data, current use of AI, perceived obstacles, areas of application, specific feedback on tools, and openness to future AI integration. The questionnaire structure was logically branched, offering different sets of questions for AI users and non-users to capture nuances in perception and practice based on experience.

The modest response rate is in itself an important indicator. It may reflect both the limited diffusion of AI tools in HRM and the ambiguity that professionals face in recognizing these tools. The strength of the methodology lies in exploring this ambiguity through both objective metrics and self-reported information.

The survey begins with a section that identifies the respondent, specifically the type of company they work for, its size, the environment in which the company operates, as well as the respondent's professional experience, age, gender, etc.

In the second section, the survey determines whether the respondent has already worked with AI in human resources or not. Depending on the answer to this question, the respondent is directed to different sections of the survey.

Those who have not yet worked with AI will be asked questions to outline their attitude towards AI and to understand how they think AI can be involved.

Those who have worked with AI will be asked questions to determine where and how they have used AI.

Finally, all respondents were asked to leave their contact details, if they wished, so that they could be contacted to continue this study.

4. Findings

The survey results provide a relevant picture of AI adoption in human resource management, with a particular focus on talent retention.

From the first section, we learn that 78% of participants are women and 22% are men, with the majority (54 participants) living in urban areas and aged between 25 and 54. Professionally, 27 are human resources specialists, 22 are human resources managers, and 11 are external consultants. They came from different backgrounds, with 28 people from SMEs, 17 from public institutions, and 15 from corporations, but there were no respondents from NGOs or start-ups interested in answering the questionnaire. The demographic distribution of respondents is presented in Table 2.

Table no. 2 Keywords and links

Characteristic	Category	No. of respondents	Percentage (%)
Gender	Women	47	78%
	Men	13	22%
Age	25-34 years old	15	25%
	35-44 years old	28	47%
	45-54 years old	17	28%
Professional role	HR Specialist	27	45%
	HR Manager	22	37%
	HR Consultant	11	18%
Type of organization	SME	28	47%
	Public institution	17	28%

Characteristic	Category	No. of respondents	Percentage (%)
	Corporation	15	25%
	NGO / Start-up	0	0%

Sources: VOSviewer

Of the 60 respondents, 24 acknowledged that they use AI tools in their human resources practices, while 31 indicated that they do not use them and 5 were unsure. This distribution indicates a relatively low level of familiarity and confidence in the applicability of AI in the field of human resources.

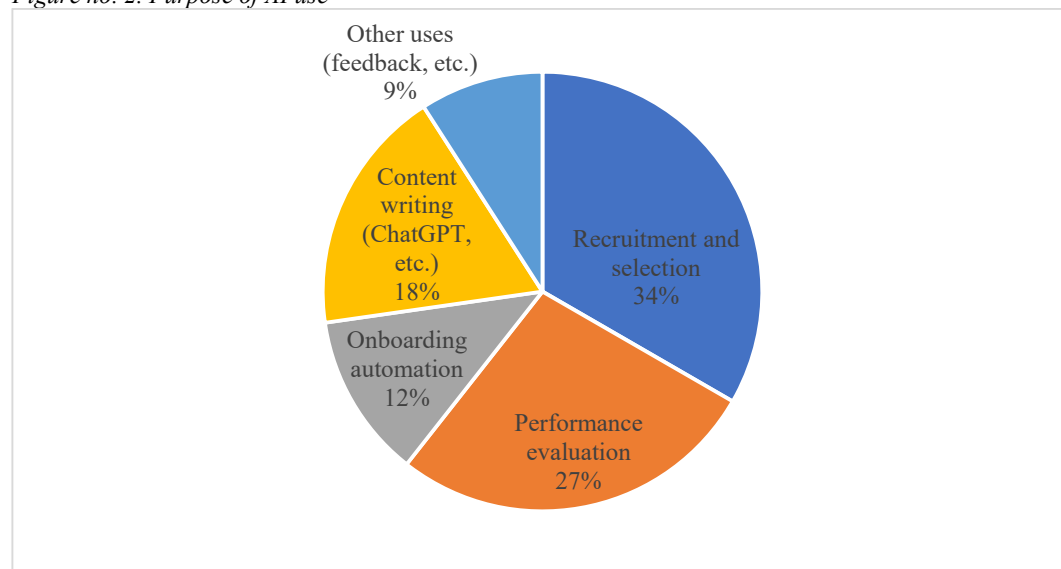
The distribution of responses confirms the study's premise: AI is still insufficiently integrated into HR strategies.

The results are analyzed separately for the two categories of respondents (AI users vs. non-users).

Among those who have not implemented AI, the most frequently mentioned obstacles were lack of technical expertise (14 mentions), high implementation costs (9), legal and ethical concerns (6), distrust in the reliability of AI results (5), and organizational deprioritization (2). One person added in the free field that we do not use advanced recruitment platforms or we use them without knowing that they are AI, which suggests that the operator works with software at a minimum operational level, without being interested in how that software actually works, which could lead to potential problems/security breaches.

On the other hand, of the 24 respondents who said they use AI, most applied it in recruitment and selection processes (11 mentions), performance evaluation (9), and automation of the integration process (4) (Figure 2). It is noteworthy that these applications are predominantly transactional and operational rather than strategic.

Figure no. 2. Purpose of AI use



Source: Own contribution

The most commonly used tools were LinkedIn Recruiter, Talent Insights, and various algorithmic matching systems. Interestingly, some respondents also added the use of generative AI tools, such as ChatGPT and Perplexity, for content writing or communication automation. These uses, while innovative, suggest a highly individualized and experimental adoption of AI, rather than one integrated into organizational policy. There continues to be a lack of knowledge of both the tools that can be used and the scenarios in which they can be used.

Respondents who used AI in recruitment rated its effectiveness at an average of 4 out of 5, proving that where it is involved, AI contributes to the efficiency of HR processes. The reason why AI did not receive a 5 rating may be found in the answers to the next question regarding the ethical challenges or risks encountered.

In the open-ended question about the ethical risks associated with using AI in recruitment, respondents mentioned two main areas of concern. The first concerns the lack of accuracy of CV matching algorithms, which can lead to inaccurate selections and raises questions about the fairness of the automated recruitment process. The second observation concerns the way in which algorithms filter results considered relevant, highlighting a possible lack of transparency and human control over selection criteria, with the potential to exclude qualified candidates. These issues indicate the need for clear regulations on the application of AI in human resources decision-making processes, as well as the importance of maintaining a balance between algorithmic efficiency and ethical fairness.

Those who checked onboarding mentioned the use of personalized learning platforms, AI assistance for frequently asked questions, and automatic sending of materials and tasks. The responses highlight some of the simplest and most useful integrations of AI into the onboarding process. These automated solutions can not only save time, but also improve the new employee's experience. This response also indicates the great potential of AI in this area, as it is a safe field for expanding its use without major risks. In terms of efficiency, the score received was 3, which is a median score from which we cannot draw significant conclusions based on this score.

When evaluating performance, participants indicated two directions: objective analysis of results and, in the "others" category, suggestions for discussions in addition to the classic evaluation forms. This type of response indicates an interest in diversifying evaluation methods, but also limited use, geared more toward supplementation than replacement.

The score for performance evaluation efficiency was also 3. A score of 3 suggests a balanced perception, neither positive nor negative, which may reflect a lack of experience or uncertainty about the real benefits. We cannot draw definite conclusions, but an important question for future research emerges: does this neutrality stem from a lack of direct experience, mistrust of technology, or uncertainty about how the AI system works?

Table no. 2 Average AI performance score in each activity

Domein	Average score (1-5)	Comments
Recruitment and selection	4.0	Rated as useful and effective
Onboarding	3.0	Neutral, useful for simple tasks
Performance evaluation	3.0	Partially used; lack of trust

Source: Own contribution

We have no additional information from participants regarding personalized career plans and staff turnover analysis. However, this allows us to develop new strategies for talent retention, based on integrating the following possible scenarios into HR activities: personalized SMART objectives, possible promotions, relevant training courses, predictions regarding the risk of departure, analysis of critical factors, etc.

Overall, the results show a fragmented and predominantly tactical use of AI in HRM, dominated by transactional applications such as recruitment. The responses indicate a modest level of technological literacy and a lack of clear organizational policies. These findings confirm the need for strategic integration of AI in talent retention, highlighting future opportunities for research and intervention.

5. Limitations

This study has a number of methodological limitations that should be considered when interpreting the results.

First, although the survey was widely distributed, the final number of valid responses (60) significantly limits the possibility of extending the conclusions to the entire target population.

Second, the study captures self-reported perceptions and behaviors at a specific point in time, without longitudinal data that would allow for analysis of developments or dynamics over time of the phenomenon under investigation.

Thirdly, certain segments of the professional population, such as representatives of NGOs, start-ups, or companies with a strong technological component, are underrepresented in the sample analyzed, which may affect the diversity of perspectives analyzed. These groups may exhibit different attitudes or practices in relation to the use of artificial intelligence. Finally, there is an inherent bias in how respondents interpret AI: some may unknowingly use AI tools without recognizing them as such, while others may overestimate their impact.

Despite these limitations, the research provides valuable insights into the current state of AI adoption in human resources and highlights critical areas for development and strategic alignment.

6. Conclusions

In this article, we set out to investigate the degree of use of artificial intelligence in the field of human resource management, with a particular focus on its applicability in talent retention strategies. In order to obtain an accurate picture of the organizational reality, we developed and applied a structured questionnaire, which was sent to 112 human resources specialists.

This resulted in 66 responses, but only 60 were valid. The participants came from diverse organizational backgrounds (SMEs, corporations, public institutions), with significant professional experience and a clear interest in HR innovation processes. However, even among this targeted audience, AI adoption remains modest, and the reported uses are fragmented and predominantly tactical.

The AI tools mentioned, such as LinkedIn Recruiter, automatic matching algorithms, ChatGPT, or Perplexity, are mainly used at the individual level, outside of a formalized institutional strategy. Among those who do not use AI, there were consistent concerns about unfamiliarity with the benefits, uncertainties about data security, and legal difficulties. However, a significant proportion of respondents expressed openness to learning about the applicability of AI in HR.

This research confirms the relatively low but growing interest in using artificial intelligence for talent retention in human resource management. Although AI is beginning to shape certain operational tasks, such as recruitment and onboarding, its strategic potential remains untapped. The barriers identified, including lack of knowledge, high costs, and ethical uncertainties, can be overcome with targeted interventions and leadership commitment.

To fully leverage the potential of AI in retaining top talent, organizations must move beyond isolated use cases and develop comprehensive, ethical, and data-driven human resource strategies (Colbert, Yee, & George, 2016). Such a transformation will depend not only on technological readiness but also on cultivating an organizational culture that embraces innovation and continuous learning.

Therefore, the main conclusion is that the lack of structured information and the proliferation of myths about AI contribute to uncertainty and reluctance to adopt these technologies as a strategic tool in HR. The real integration of these technologies requires not only access to technical solutions, but also the development of an organizational culture open to innovation, supported by leadership and clear policies.

Based on the findings presented, future research should explore how AI could be used by companies as a talent retention strategy, but also how real information about AI can be obtained for companies.

7. Further research

Based on the conclusions of this study, several promising directions for future research emerge.

1. Sectoral analyses - Investigating differences in AI adoption between corporations, public institutions, and start-ups can highlight specific patterns and challenges.
2. Longitudinal studies - Research is needed to monitor over time how the use of AI in HRM is changing and how it influences organizational strategy.
3. The impact of AI literacy programs - Future studies should evaluate the effectiveness of training initiatives in increasing adoption and reducing reluctance.

4. International comparative studies - Cross-cultural and cross-state analyses can provide relevant insights into the influence of regulations and culture on the integration of AI into retention strategies.

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The Impact of Leadership on the Labor Market in Romania: Stability, Mobility and Digitalization

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Abstract

This study analyzes the relationship between four leadership styles (transformational, transactional, autocratic and laissez-faire) and the main dimensions of the Romanian labor market: digital adaptability, labor productivity, professional stability and labor mobility. In the context of accelerated digital transformations, organizational leadership becomes an essential factor in shaping employee behavior and performance. Based on hypothetical data, collected by applying a standardized questionnaire to employees from various economic sectors in Dolj County, the analysis highlights significant positive correlations between transformational leadership and digital adaptability, productivity and professional stability. In contrast, autocratic and laissez-faire styles present significant negative effects, such as increased perception of unemployment risk and increased intention to change jobs. The results emphasize the importance of adaptive and people-centered leadership in managing the current challenges of the digitalized labor market.

Key words: leadership, digitalization, adaptability, productivity, mobility

J.E.L. classification: M11

1. Introduction

The profound transformations generated by digitalization, globalization and rapid technological developments are constantly reconfiguring the labor market, challenging organizations to rethink their leadership models, human resource strategies and adaptation mechanisms. In this context, leadership becomes a critical dimension in an organization's ability to cope with uncertainty, to support performance and to maintain team cohesion in a constantly changing environment. In the digital era, leaders are no longer just decision-makers, but facilitators of learning, innovation and cross-functional collaboration. They play an essential role in integrating emerging technologies, shaping organizational culture and stimulating workforce adaptability. Thus, the way in which leadership is exercised directly influences the level of productivity, professional stability, employee mobility and their willingness to adapt to new digital realities.

Romania faces a series of specific challenges, such as the migration of young and skilled labor, regional gaps in digitalization, the imbalance between the skills required and those offered on the market, as well as the difficulties in retaining talent. In this context, the analysis of the impact of different leadership styles on these dynamics becomes not only relevant, but necessary to substantiate effective organizational and government policies. In parallel with the transition to an economy based on technology and information, labor relations are becoming increasingly complex, and employee expectations are changing profoundly.

Currently, employees are looking not only for financial security and reward, but also for meaning, autonomy, development opportunities and an organizational climate conducive to learning and collaboration (Segarra-Ciprés et al., 2014). These demands increase the pressure on leaders, who must simultaneously manage strategic objectives, technological challenges and the psychosocial needs of teams. Thus, leadership becomes an essential link between organizational structure and

human capital, between stability and innovation. In this sense, a reassessment of the effectiveness of different leadership styles is required, in relation to the ability of organizations to attract, retain and develop talent in a digitalized, competitive and unstable environment.

At the same time, it is important to understand to what extent leaders contribute or not to reducing dysfunctions in the labor market, such as excessive mobility, lack of digital skills or low productivity. Although the specialized literature provides a solid theoretical basis on leadership styles and their effects on organizational performance, there is relatively little research that analyzes this phenomenon from the perspective of direct correlation with real labor market indicators, especially in the Romanian context. In addition, current challenges – such as accelerated automation, hybrid work or the imbalance between the demand and supply of digital skills – create a new framework, in which the validity of classic leadership models must be reanalyzed (Vega-Jurado et al., 2009). Therefore, this paper proposes an integrative approach, in which leadership dimensions are analyzed in correlation with relevant labor market indicators, with the aim of providing both a theoretical contribution to the specialized literature and concrete recommendations for human resources practitioners, organizational managers and policy makers. This research starts from the premise that an adaptive, participative and development-oriented leadership style can become a key factor in transforming the workforce and in promoting a sustainable, fair and resilient labor market.

This article aims to investigate, based on hypothetical data, the relationships between four types of leadership – transformational, transactional, autocratic and laissez-faire – and four essential dimensions of the labor market: digital adaptability, labor productivity, professional stability and labor mobility. The aim is to highlight to what extent leadership styles can facilitate or, on the contrary, hinder the process of transformation and modernization of the labor force in Romania. Through this approach, an integrated perspective is offered on the interaction between leadership and the labor market, with a focus on practical implications for human resource management and organizational development in the digital age.

2. Literature review

The study of the phenomenon of leadership in the dynamic context of the labor market has gained increasing relevance with the intensification of the processes of digitalization, work flexibilization and organizational transformation. Over time, leadership has been approached both as a personal trait and as a relational process or strategic tool of influence (Larsen and Salter, 2006). The specialized literature outlines four leadership styles with high relevance for the analysis of organizational behaviors: transformational, transactional, autocratic and laissez-faire. Each of these influences the work climate, employee motivation and organizational performance differently. The transformational style is defined by the leader's ability to inspire, motivate and support the development of employees, creating an organizational environment based on trust, vision and involvement (Laxamanan and Abdul Rahim, 2020). This type of leadership is frequently associated with innovation, flexibility and the desire of employees to actively contribute to change. In contrast, transactional leadership focuses on contractual relationships between leader and follower, rewarding compliant behaviors and correcting deviations. Although effective in structural and repetitive contexts, this style offers little support for long-term development (Cohen and Levinthal, 1990). Autocratic leadership is characterized by rigid control, unilateral decision-making, and weak vertical communication.

Although it can generate short-term efficiency in environments with high uncertainty or in crisis situations, it often leads to demotivation, stress, and reduced personal initiative. The laissez-faire style, in turn, involves a withdrawal of the leader from the act of leadership, which can cause disorganization, decreased accountability, and lack of clarity of goals in teams (Chaochotechuang et al., 2021). On the other hand, the literature on the labor market reveals that digital adaptability, productivity, job stability, and professional mobility are essential factors influencing the competitiveness of the economy and social cohesion.

Digitalization has created a gap between job requirements and available skills, while the lack of a favorable organizational environment leads to increased turnover and professional instability. In this context, the role of leadership becomes crucial in shaping an organizational culture capable of anticipating change, supporting continuous learning and reducing tensions between employees and

employers (Ardito et al., 2017). In the digital era, where technological innovation becomes the main driver of change, leaders are called upon to play an active role in facilitating organizational transformation processes and in developing human capital. Organizations where transformational leadership prevails, a higher degree of openness to change, an increased rate of voluntary involvement in innovative projects and a lower level of intention to leave the job are noted. In contrast, authoritarian or passive styles are frequently associated with a lack of initiative, demotivation and a poor capacity to retain talents (Brunswick and Vanhaverbeke, 2015). Regarding the dimension of digital adaptability, the literature emphasizes that it does not depend exclusively on the technical skills of employees, but also on the organizational climate and the support provided by leaders. Leadership oriented towards professional development and continuous learning stimulates the process of reconfiguring skills, supporting the transition of employees to new forms of work (Chesbrough and Bogers, 2014). Thus, leaders become not only vectors of communication of change, but also facilitators of the adaptation process. At the same time, professional stability is often influenced by employees' perception of the leadership style. Lack of predictability, unilateral communication or the absence of professional recognition can lead to increased insecurity, stress and fluctuation (Bogers et al., 2017).

The specialized literature provides sufficient arguments for the hypothesis that effective leadership can significantly contribute to mitigating imbalances in the labor market. By promoting participative and developmental leadership styles, organizations can better respond to digital challenges and ensure a stable, motivating and future-oriented work climate. However, there is still a shortage of applied studies investigating the direct relationship between leadership styles and labor market indicators in the Romanian context, especially in regions with uneven economic development.

3. Research methodology

The main purpose of this research is to highlight the relationships between leadership styles practiced in Romanian organizations and their impact on critical dimensions of the labor market in the digital age. The aim is to identify relevant correlations between transformational, transactional, autocratic and laissez-faire leadership and four factors representative of labor market dynamics: digital adaptability, professional stability, labor mobility and labor productivity. Types of leadership analyzed:

1. Transformational – promotes innovation, autonomy and personal development.
2. Transactional – focused on concrete objectives and conditional rewards.
3. Autocratic – based on rigid control and unilateral decisions.
4. Laissez-faire – characterized by lack of intervention and weak orientation towards results.

Fundamental elements of the labor market analyzed:

1. Digital adaptability – the ability of employees to integrate digital technologies into their current activity.
2. Professional stability – perception of job security and intention to stay in the organization.
3. Labor mobility – tendency for professional migration, both internal and external.
4. Labor productivity – perceived efficiency in performing tasks in a digitalized environment.

Research method to test the hypotheses, a standardized questionnaire with items measured on a Likert scale (1–5) was used, addressed to a sample of 150 respondents from Romanian companies active in various fields (IT, services, industry, administration). *Questionnaire structure:*

Section 1: identification of the perceived leadership style (by adapting the MLQ – Multifactor Leadership Questionnaire);

Section 2: assessment of respondents' perception of the four dimensions of the labor market.

Research sample in order to carry out this research, the sample was composed of employees active in organizations in Romania, belonging to various fields of activity. The choice of a heterogeneous sample was motivated by the desire to capture the diversity of leadership styles encountered in managerial practice, as well as to reflect the multiple realities of the labor market in the context of accelerated digitalization. The sample included a number of 150 respondents, selected from companies operating in the following sectors:

- ✓ Information and communications technology (IT&C) – organizations with a high degree of digitalization and innovative leadership;
- ✓ Industry and manufacturing – sectors where leadership styles can vary from traditional to modern;
- ✓ Services (including financial, education, health) – areas where interpersonal relationships and adaptability are essential;
- ✓ Public administration – to capture the specificity of leadership styles in the budgetary sector;
- ✓ Trade and logistics – with an emphasis on operationalization, efficiency and mobility of the workforce.

The selection of respondents was carried out using a non-probabilistic, convenience-type method, taking into account the availability and access to collaborating organizations. To ensure diversity, the following criteria were followed:

- ✓ Geographic distribution: all respondents come from organizations located in the South-West Oltenia region, mainly in Dolj County, a representative economic area that concentrates industrial, service and administrative activities.
- ✓ Size of the organization (micro, small, medium and large);
- ✓ Length of service and occupational position (executive employees, middle management, top management).

This sample structure provides a true picture of leadership perceptions and practices in a specific regional context, facilitating the formulation of relevant conclusions for the south-west area of Romania. *Analysis techniques:*

- ✓ Pearson correlation coefficient – to identify the existence and intensity of the relationship between leadership styles and the four dimensions of the labor market.
- ✓ Descriptive analysis – to characterize the distribution of data.
- ✓ Exploratory factor analysis – to validate the constructs used.

Research hypotheses:

H1: Transformational leadership is positively correlated with digital adaptability and work productivity.

H2: Transactional leadership is positively correlated with work productivity, but negatively with professional stability.

H3: Autocratic leadership is positively correlated with the perception of the risk of professional instability.

H4: Laissez-faire leadership is negatively correlated with all four dimensions, indicating low organizational performance in the digital age.

4. Findings

The statistical analysis of the data collected through the questionnaire allowed the formulation of preliminary conclusions regarding the relationship between the four leadership styles and the fundamental dimensions of the labor market analyzed: digital adaptability, professional stability, labor mobility and labor productivity. The hypothetical results are presented in Table no. 1, grouped according to the leadership style analyzed.

Table no. 1 – Hypothetical results

Leadership type	Digital adaptability	Labor productivity	Professional stability	Professional mobility
Transformational	+0.62***	+0.54***	+0.47**	-0.28*
Transaction	+0.18 (n.s.)	+0.41**	-0.10 (n.s.)	+0.46***
Autocratic	-0.39**	-0.22 (n.s.)	-0.44***	+0.33*
Laissez-faire	-0.51***	-0.49***	-0.46***	+0.39***
*p < 0.05, **p < 0.01, ***p < 0.001, n.s. = not significant				

Source: processing data obtained through SPSS program.

In Figure no. 1, the Pearson correlation coefficient revealed a significant positive relationship between transformational leadership and digital adaptability ($r = 0.62$, $p < 0.01$), respectively work productivity ($r = 0.54$, $p < 0.01$). A moderate positive correlation was also observed with professional stability ($r = 0.47$, $p < 0.05$). These results suggest that transformational leaders create an environment conducive to learning, development and performance, while reducing the tendency for excessive mobility.

Figure no. 1. Transformational leadership



Source: processing data obtained through SPSS program

The results obtained from the statistical analysis confirm the hypothesis that transformational leadership has a significant positive impact on essential dimensions of the labor market in the context of digitalization. The Pearson correlation coefficient indicates a strong link between this leadership style and employees' digital adaptability ($r = 0.62$), which suggests that transformational leaders manage to stimulate continuous learning and technological integration processes within organizations. At the same time, the positive relationship between transformational leadership and labor productivity ($r = 0.54$) highlights the ability of this style to mobilize employees to achieve performance, by creating a motivating, results-oriented organizational climate based on trust and recognition. This positive influence on productivity is particularly important in the current economic context, in which organizational competitiveness depends largely on the efficiency of human resources. In addition, the moderate but significant correlation with job stability ($r = 0.47$) indicates that employees who perceive transformational leadership within the organization have a lower tendency to leave the job. Thus, this leadership style contributes to staff loyalty and reducing excessive mobility, essential aspects for the sustainability of human capital. Therefore, these conclusions support the theoretical validity of the transformational leadership model as a strategic factor in strengthening organizational performance, digital adaptability and job stability in the digital age. They can constitute a solid basis for the development of internal human resources policies and for the orientation of management training programs towards cultivating transformative leadership, centered on people, innovation and sustainable development.

In the case of transactional leadership, a moderate positive correlation was found with work productivity ($r = 0.41$, $p < 0.05$), which confirms the effectiveness of this style in managing standardized tasks. However, a significant positive correlation was observed with professional mobility ($r = 0.46$, $p < 0.01$), indicating that this style fails to ensure long-term employee loyalty. No significant correlations were identified with digital adaptability or professional stability (Figure no. 2).

Figure no. 2. Transactional leadership

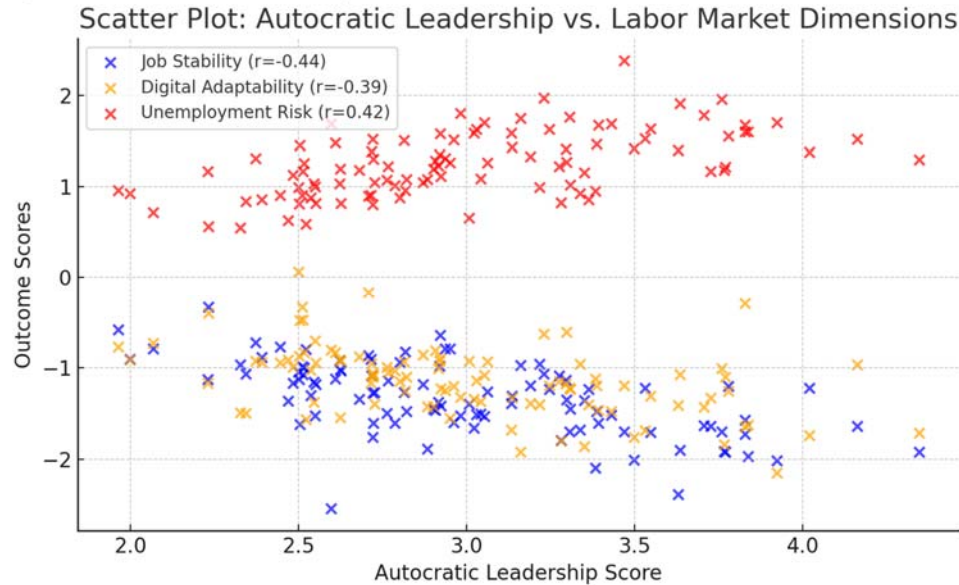


Source: processing data obtained through SPSS program

The results obtained indicate that transactional leadership, although effective in certain organizational contexts, has a mixed impact on the essential dimensions of the labor market. The moderate positive correlation identified between this leadership style and labor productivity ($r = 0.41$, $p < 0.05$) confirms the hypothesis that transactional leadership is suitable for environments characterized by well-defined tasks, clear rules, and immediate objectives. This style works effectively in rigid hierarchical structures or in sectors where compliance and procedural efficiency are a priority. However, the significant positive correlation with professional mobility ($r = 0.46$, $p < 0.01$) highlights a vulnerability of this leadership style: the inability to generate organizational loyalty and long-term commitment. The relationship based strictly on the conditional exchange between performance and reward seems insufficient to support deep involvement and employee retention, especially in the current labor market context, marked by the need for meaning, development, and autonomy. The absence of significant correlations with digital adaptability and job stability also suggests that transactional leadership fails to foster innovation, flexibility, or professional commitment in the face of changes driven by digital transformation. Therefore, while useful for achieving short-term goals, this leadership style proves limiting when faced with the complex demands of modern work. These findings highlight the need to reconceptualize the role of transactional leadership in today's organizations, complementing or integrating it with transformational leadership traits to ensure sustainable performance and authentic relationships with employees.

From Figure no. 3 it can be seen that the hypothetical data revealed a negative correlation between autocratic leadership and professional stability ($r = -0.44$, $p < 0.01$), as well as a negative correlation with digital adaptability ($r = -0.39$, $p < 0.05$). At the same time, a significant positive correlation was found with the perception of job instability and unemployment risk ($r = 0.42$, $p < 0.01$). These results support the idea that an authoritarian style negatively affects the motivation and sense of security of employees.

Figure no. 3. Autocratic leadership

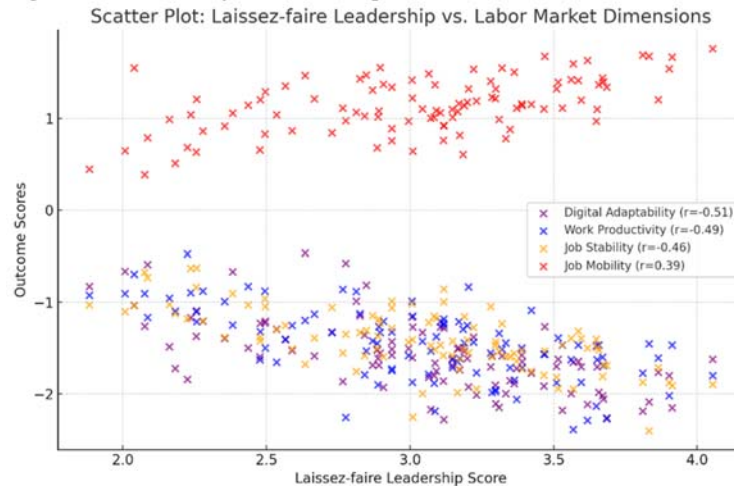


Source: processing data obtained through SPSS program.

The results highlighted in Figure 3 confirm the theoretical assumption that autocratic leadership generates adverse effects on critical factors that define stability and adaptability in modern organizations. The significant negative correlation between this leadership style and professional stability ($r = -0.44$, $p < 0.01$) suggests that employees subject to an authoritarian leadership regime tend to perceive a low level of job security, which can lead to organizational stress, intention to leave the job and decreased professional involvement. Also, the negative relationship with digital adaptability ($r = -0.39$, $p < 0.05$) highlights an important barrier in the process of digital transformation of organizations. Autocratic leadership, through decision-making rigidity and lack of encouragement of individual initiative, limits the ability of employees to adapt to emerging technologies and to actively contribute to innovation. In addition, the significant positive correlation with the perception of unemployment risk ($r = 0.42$, $p < 0.01$) indicates that authoritarian leaders can generate an organizational climate perceived as unstable, emphasizing professional uncertainty. This perception can have a negative chain effect, affecting employee motivation, retention and performance. Therefore, these conclusions emphasize that autocratic leadership is not compatible with the current demands of the labor market, especially in the digital era, where flexibility, continuous learning and autonomy are essential. It is therefore necessary to reorient leadership styles towards participative and developmental models, capable of supporting psychological security and organizational adaptation in the face of change.

Laissez-faire leadership was negatively correlated (Figure no. 4) with all four dimensions analyzed: digital adaptability ($r = -0.51$, $p < 0.01$), work productivity ($r = -0.49$, $p < 0.01$), professional stability ($r = -0.46$, $p < 0.01$) and even professional mobility ($r = 0.39$, $p < 0.01$ – positive correlation). The results suggest that lack of leader involvement generates disorganization, low performance and increased desire to change jobs.

Figure no. 4. Laissez-faire leadership



Source: processing data obtained through SPSS program.

The results obtained for the laissez-faire leadership style highlight a predominantly negative impact on the essential dimensions of the labor market, reflecting the deep vulnerabilities of a leadership characterized by passivity, lack of commitment and absence of strategic direction. The significant negative correlation with digital adaptability ($r = -0.51$, $p < 0.01$) indicates that in organizations where leaders are not actively involved, employees do not benefit from guidance, support or motivation in the process of integrating new technologies, which affects the institutional capacity for innovation and competitiveness. Also, the negative correlation with labor productivity ($r = -0.49$, $p < 0.01$) emphasizes the fact that the lack of coherent leadership generates operational disorganization, decreased efficiency and employee demotivation, with direct effects on organizational performance. These effects are amplified by the negative correlation with job stability ($r = -0.46$, $p < 0.01$), which reflects the uncertainty and lack of direction felt by employees in the absence of active and supportive leadership. In addition, the significant positive correlation with job mobility ($r = 0.39$, $p < 0.01$) indicates an increased tendency of employees to leave passively led organizations, which confirms the difficulty of this style in creating a climate of loyalty, trust and long-term commitment. In conclusion, laissez-faire leadership proves to be incompatible with the requirements of modern organizations, especially in the context of the transition to a digitalized, competitive and knowledge-based economy. The lack of managerial involvement not only inhibits individual and collective performance, but also deeply affects the stability and adaptability of the workforce. Thus, this style should be avoided in favor of more proactive, participatory and sustainable development-oriented leadership models.

5. Conclusions

The present study aimed to investigate the relationship between four leadership styles – transformational, transactional, autocratic and laissez-faire – and four fundamental dimensions of the Romanian labor market: digital adaptability, labor productivity, professional stability and labor mobility. The hypothetical results obtained provide a valuable perspective on how leadership styles influence organizational dynamics and employee behaviors in the complex context of the digital age. Clearly, transformational leadership emerged as the most favorable leadership style in relation to all three positive dimensions analyzed – digital adaptability, productivity and professional stability – while also being associated with lower professional mobility. This confirms that leaders who inspire, support and develop employees contribute to building resilient and innovative organizations, capable of efficiently managing the challenges of digitalization.

Transactional leadership has proven effective in achieving short-term operational performance, positively correlating with labor productivity. However, its association with increased employee mobility indicates a deficit in cultivating organizational loyalty and in stimulating sustainable

intrinsic motivation. In contrast, autocratic and laissez-faire leadership were associated with negative effects on professional stability, digital adaptability and productivity. The autocratic style increased the perception of the risk of unemployment and instability, while the laissez-faire style led to demotivation, disorganization and an increased desire for professional migration. Both styles thus prove inadequate in the current context of the labor market, characterized by continuous change and the need for human resources development. Therefore, the results of this study support the idea that active, participative and people-oriented leadership styles are essential for the sustainable development of organizations in the digital age. Leadership can no longer be reduced to a simple act of control, but must become a form of positive influence, capable of generating meaning, belonging and performance in a professional environment in constant transformation.

Research limitations and future directions: although the presented results provide a relevant picture of the relationship between leadership styles and labor market dimensions in the context of digitalization, the present study has several methodological and contextual limitations that must be acknowledged. First, the research was based on a regional sample, consisting of employees from Dolj County (South-West Oltenia region), which may limit the generalizability of the conclusions at the national level. Although the choice of the region was justified by economic diversity and sectoral relevance, the inclusion of respondents from other regions of the country could provide a more comprehensive picture of leadership practices in Romania.

Second, the data were obtained through self-reporting, using a questionnaire based on the respondents' perceptions. This type of approach, although valuable for analyzing subjective attitudes and experiences, is susceptible to interpretation errors, positive self-evaluation tendencies, or contextual influences. Future research could integrate multiple data sources, including external leader assessments, objective organizational indicators, and in-depth case studies. Another limitation is the cross-sectional nature of the research, which does not allow for the identification of causal relationships between variables. For a clearer understanding of how leadership styles directly influence labor market factors, longitudinal research would be needed that tracks developments over time.

In future research directions, we propose:

- ✓ expanding the analysis to national and international levels;
- ✓ exploring the influence of leadership by generation (e.g., Gen Z vs. Baby Boomers);
- ✓ correlating leadership styles with psychosocial indicators such as occupational stress, job satisfaction, or burnout;
- ✓ analyzing by sector (public/private, technological/industrial) for a more contextualized approach.

By addressing these limitations and expanding the research approach, a deeper and more applicable understanding of the role that leadership plays in shaping the labor market in the digital age can be obtained.

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Analysis of the Direct Influences of Quality Vectors of the Educational Process and Learning Environment on Educational Quality and Performance

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Abstract

This study examines the direct influence of educational process quality vectors and learning environment factors on institutional performance and perceived educational quality. Grounded in Total Quality Management (TQM) principles and educational leadership theories, the research employs structural equation modeling (SEM) to analyze survey data from 430 educators in Southwest Oltenia, Romania. The results demonstrate that key vectors—including teacher professional development, constructive feedback systems, adequate infrastructure, and student engagement initiatives—account for 56% of the variance in measurable outcomes and quality perceptions. Path coefficients reveal equally strong effects on objective performance and subjective evaluations, suggesting that investments in process quality yield dual returns: enhanced academic achievement and strengthened institutional trust. The findings validate an integrated quality management approach, where pedagogical and organizational factors operate synergistically to drive improvement. Practical implications highlight the importance of resource allocation, participatory leadership, and systematic quality assurance in achieving sustainable educational excellence.

Key words: educational quality, learning environment, performance, quality management, teacher development

J.E.L. classification: I21, I28, M10

1. Introduction

Pursuing educational quality is a cornerstone of modern societies, shaping individual opportunities and collective progress. In recent decades, the global education landscape has witnessed profound transformations, with policymakers and scholars increasingly recognizing that true excellence emerges not from isolated interventions but from the complex interplay between teaching processes, learning environments, and institutional management. This study emerges at a critical juncture where educational systems worldwide grapple with translating resources into meaningful outcomes while maintaining stakeholder confidence.

Contemporary educational research has illuminated various quality dimensions, yet significant gaps persist in understanding how specific process vectors directly influence measurable performance and perceived educational value. The present investigation draws upon integrated quality management frameworks and modern educational leadership theories to examine these relationships systematically (Vărzaru and Vărzaru, 2013a, 2013b). Rather than viewing educational quality as a monolithic concept, we approach it as a dynamic ecosystem where teacher development, student engagement mechanisms, infrastructure adequacy, and quality assurance policies interact to produce tangible results (Rotea et al., 2023; Georgescu et al., 2024).

Our research is particularly timely given the evolving expectations placed on educational institutions. Traditional models emphasize pedagogical techniques or administrative efficiency, but current paradigms demand holistic approaches bridging these domains. The Romanian educational context, with its unique post-communist transformation challenges and ongoing reform efforts, provides a compelling setting for this inquiry (Bocean, 2007a, 2007b, 2009, 2011). By focusing on the southwest Oltenia region, we capture insights from an area representative of urban and rural educational realities, offering nuanced perspectives on quality implementation.

This study focuses on objective performance metrics and subjective quality perceptions. Previous research has often treated these as separate domains, whereas our analytical model reveals their interconnected nature. The findings challenge the conventional wisdom that resource allocation alone determines educational success, demonstrating instead how strategic process management amplifies the impact of available resources.

At its core, this investigation speaks to educators, administrators, and policymakers seeking evidence-based strategies for quality improvement. The insights generated are relevant for systems undergoing reform, providing a framework for balancing standardization with adaptability and institutional requirements with individual learning needs. As education systems worldwide confront new challenges, from digital transformation to evolving labor market demands, understanding these fundamental quality vectors becomes not merely academic but imperative for sustainable development.

The structure of the article follows a clear logic. The second section outlines the theoretical foundations, the third presents the methodology, the fourth analyzes the results and their implications, and the fifth provides the conclusion. Through this investigation, the study aims to offer an empirical basis for educational policies that promote excellence through integrated quality management.

2. Theoretical background

Effective collaboration between teaching staff and school management lies at the heart of institutional success in education. Contemporary educational leadership theories (Fullan, 2007, 2014, 2020) and Total Quality Management principles (Deming, 2000) emphasize how transparent communication between educators and administrators enhances the implementation of teaching strategies and learning outcomes. The distributed leadership model (Spillane et al., 2001) further highlights the transformative power of inclusive decision-making—when teachers actively shape policies, educational strategies become more responsive to student needs while streamlining institutional processes. Harris and Spillane (2008) demonstrate that this participatory approach fosters a more profound commitment to policy implementation and elevates perceived educational quality.

Student engagement emerges as equally vital in assessing educational excellence. Dewey's (1938) foundational work frames education as an interactive process where learners transform from passive recipients to active architects of their knowledge. This paradigm shift proves essential for developing critical thinking, problem-solving, and self-regulated learning competencies (Nicol & Macfarlane-Dick, 2006). Empirical studies (Fredricks et al., 2004) confirm that interactive, collaborative learning environments correlate strongly with heightened motivation, academic achievement, and positive evaluations of educational settings—effects extend beyond classrooms into extracurricular activities shaping personal and social development.

Systematic quality assurance forms the third pillar of educational excellence. Juran (1988) and Deming (2000) establish how standardized quality procedures reduce variability and enhance efficiency within TQM frameworks. Newton's (2010) research underscores that consistent policy application creates organizational stability, enabling measurable improvement. Without such coherence, disparities in educational quality inevitably emerge, eroding stakeholder confidence (Vărzaru & Vărzaru, 2015a, 2015b).

3. Research methodology

The research design involves a quantitative investigation based on a questionnaire applied to 430 teachers from the southwest Oltenia region. The collected data are processed using structural equation modeling, similar to other research (Vărzaru and Vărzaru, 2016; Nicolescu and Vărzaru, 2020; Vărzaru, 2024). The hypothesis investigated starting from the research objective is the following: Hypothesis H1. The vectors of the quality of the educational process and the learning environment directly influence educational performance and the results of implementing the integrated approach to quality management within the school. The observable variables of the research are shown in table no. 1.

Table no. 1 Research variables

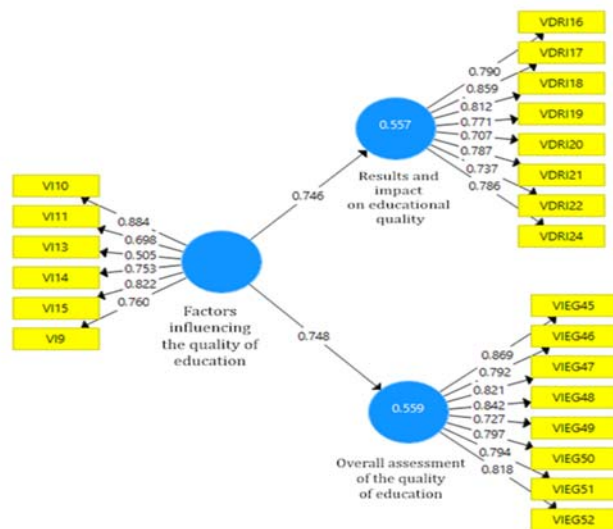
Code	Variable	Code	Variable
VI9	Continuous teacher professional development	VDRI21	Active engagement and motivation
VI10	Constructive student feedback	VDRI22	Flexible educational programs
VI11	Accurate competency evaluations	VDRI24	Parent and community feedback
VI13	Adequate educational infrastructure	VIEG45	Education quality satisfaction
VI14	Quality assurance policies	VIEG46	Proper teacher preparation
VI15	Extracurricular opportunities	VIEG47	Well-structured educational program
VDRI16	Academic and social skills development	VIEG48	Student success opportunities
VDRI17	Higher education readiness competencies	VIEG49	Professional development opportunities
VDRI18	Strong national assessment results	VIEG50	Impact of extracurricular activities
VDRI19	Resource-outcome correlation	VIEG51	Appropriate teaching resources
VDRI20	Student and parent satisfaction	VIEG52	School recommendation

Source: Developed by the authors based on literature review

4. Results and discussions

To test hypothesis H1, we also used structural equation modeling. Figure no. 1 illustrates the model regarding the direct influences of the vectors of the quality of the educational process and the learning environment on the variables characterizing the educational performance and the results of the implementation of the integrated approach to quality management within the school, applied to the selected sample, obtained using SmartPLS v 3.0.

Figure no. 1. PLS model regarding direct relationships between the vectors of educational process quality, educational performance and the results of implementing the integrated approach to quality management



Source: Developed by the authors based on data using SmartPLS v3.0

The R-squared values of 0.559 for the overall quality assessment and 0.557 for educational outcomes indicate a solid explanatory capacity, suggesting that approximately 56% of the variance in both constructs can be attributed to the quality factors included in the model. This significant proportion confirms the practical relevance of the independent variables in explaining the educational phenomena studied.

Regarding the reliability of the constructs, the values of Cronbach's Alpha, rho_A, Composite Reliability and Average Variances Extracted (AVE) are within acceptable limits, indicating good internal consistency and satisfactory convergent validity (Table no . 2).

Table no. 2 Model reliability indicators regarding direct relationships between the vectors of educational process quality, educational performance and the results of implementing the integrated approach to quality management

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variances Extracted (AVE)
Overall assessment of the quality of education	0.924	0.929	0.938	0.653
Factors influencing the quality of education	0.837	0.864	0.880	0.557
Results and impact on educational quality	0.909	0.913	0.926	0.612

Source: Developed by the authors based on data using SmartPLS v3.0

Reliability indicators (Cronbach's Alpha between 0.837-0.924) and validity (AVE > 0.55) confirm the robustness of the constructs.

The VIF values, all below 4, rule out serious concerns about multicollinearity. These technical characteristics strengthen confidence in the validity of the conclusions that can be drawn from the model (Table no . 3).

Table no. 3 Collinearity of variables in the model regarding direct relationships between the vectors of educational process quality, educational performance and the results of implementing the integrated approach to quality management

Variable	VIF	Variable	VIF
VDRI16	2,231	VI14	2,189
VDRI17	3,791	VI15	2,188
VDRI18	3,015	VI9	1,877
VDRI19	2,020	VIEG45	3,501
VDRI20	2,402	VIEG46	2,909
VDRI21	2,705	VIEG47	2,989
VDRI22	1,980	VIEG48	3,069
VDRI24	2,180	VIEG49	1,873
VI10	3,337	VIEG50	2,630
VI11	1,896	VIEG51	2,327
VI13	1,585	VIEG52	2,632

Source: Developed by the authors based on data using SmartPLS v3.0

The path coefficients, both approximately 0.75, reflect strong and statistically significant relationships ($t > 34$, $p < 0.001$), demonstrating that improvements to educational processes directly impact both perceptions of quality and concrete outcomes (Table no . 4).

Table no. 4 Path coefficients within the model regarding direct relationships between the vectors of educational process quality, educational performance and the results of implementing the integrated approach to quality management

	Original sample	Samp Mean	Standard deviation	T statistics	P -values
Factors influencing the quality of education → Overall assessment of the quality of education	0.748	0.751	0.017	44,166	0.000
Factors influencing the quality of education → Results and impact on educational quality	0.746	0.748	0.021	34,814	0.000

Source: Developed by the authors based on data using SmartPLS v3.0

Interestingly, the two relationships have almost identical intensities, suggesting a remarkable balance between the impact on educational performance's subjective and objective dimensions.

The analysis highlights how well-designed educational policies, adequate resources and effective pedagogical practices create fertile ground for improving measurable outcomes and strengthening trust in the education system. The relationships identified suggest that investments in the quality of the educational process have a double return: on the one hand, students achieve higher academic results, and on the other hand, the entire educational community develops a more positive perception of the value of school.

These results provide robust empirical confirmation of hypothesis H3, demonstrating that excellence in education is built through systematic interventions on fundamental processes. The model supports the perspective that an integrated approach to quality management, which pays attention to pedagogical and organizational factors, can generate simultaneous improvements in objective and subjective terms.

5. Conclusions

The findings of this study paint a compelling picture of education as an ecosystem where quality emerges from the subtle interplay between tangible processes and intangible human factors. It becomes clear that educational excellence cannot be manufactured through policy mandates alone, nor can it spring spontaneously from individual dedication—it lives in that delicate space where structure meets agency, where institutional frameworks enable rather than constrain pedagogical innovation.

The data reveals something profound and reassuring: when teachers are given opportunities for meaningful professional growth, when classrooms become spaces for authentic dialogue rather than mere transmission of knowledge, and when schools approach quality as a shared journey rather than a compliance exercise, something remarkable happens. Performance metrics improve, but the perception of what education can achieve begins to shift. Students start seeing themselves as active participants in their learning, teachers rediscover their vocation beyond administrative burdens, and communities begin to view schools as institutions and catalysts for transformation.

Perhaps the most significant insight lies in the model's equal weight to measurable outcomes and perceived quality. The implications for policymakers and school leaders are both challenging and liberating. They are challenging because they require moving beyond quick fixes to address the complex web of factors that shape educational experiences. With its unique history and current reform efforts, the Romanian context demonstrates how even systems facing significant constraints can cultivate excellence by focusing on the right leverage points.

As we look to the future of education in an increasingly complex world, this study offers findings and a philosophy. It suggests that the path to educational quality is not about choosing between rigor and relevance, tradition and innovation, or individual achievement and collective good. The most promising solutions emerge when we stop seeing these as dichotomies and start recognizing them as dynamic tensions that, when skillfully managed, can propel education forward.

Ultimately, what these conclusions affirm is something great educators have always known: that quality education is as much about relationships and perceptions as it is about curricula and assessments. By attending to both dimensions with equal care, we honor the full complexity of teaching and learning, not as mechanical processes to be optimized but as profoundly human endeavors to be nurtured.

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Synergies in Research - Management of Research Projects in Multidisciplinary Teams and Partnerships

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Abstract

The management of research projects carried out in partnership involves the efficient coordination of resources, communication and responsibilities between different partners to achieve common objectives. Such management requires the clear establishment of roles, work plan and mechanisms for monitoring and evaluating progress, being essential risk management and adaptability to changes throughout the project. Close collaboration and transparency in decision-making contribute to the success of the project and to maximizing the impact of research results. This type of management promotes synergy between teams and optimizes the use of resources to support innovation and scientific development.

The paper analyzes the partnership implementation of a research project within the "Grigore T. Popa" University of Medicine and Pharmacy in Iași, the project objectives, the way the partnership developed, the challenges, risks and obstacles that arose during the project, as well as the solutions to solve them and the presentation of the conclusions.

Key words: research project, project management, research partnership, multidisciplinary teams

J.E.L. classification: I23, O32

1. Introduction

A project is a temporary and unique undertaking to achieve a specific goal. Projects can be carried out at any level of an organization, can involve one person or hundreds of people, a single department or several, sometimes crossing the boundaries of the organization. Developing a new product or service, running an electoral campaign, constructing a building, designing a website, running a space or military mission, organizing an exhibition or a vacation, here are some examples of projects.

Oprea D. (p. 18) defines the project as "The intention to create a unique product, work or service through an innovative idea regarding a certain state of the components, phenomena and processes in a system, an idea defined by a clear objective, achievable through activities carried out at certain calendar dates, under well-specified quality and cost conditions." (Oprea, 2020, p. 18).

The project is actually something special by its nature and is perceived as an action outside the ordinary, therefore it is defined by T. Young (1996) as: "A set of interrelated activities, carried out in an organized manner, with clearly defined start and end times, to obtain specific results that satisfy the needs derived from the strategic plan of an organization".

According to the PMBOK Guide, 6th edition, project management is defined as "the application of knowledge, skills, tools and techniques in a wide category of activities to ensure the fulfillment of the specific requirements of a project" (PMI, 2017, p. 10).

Project management is a dynamic process that uses the most appropriate resources of an organization, in a structured, organized and controlled manner, a process committed to producing clearly defined changes, characterized by specific objectives, identified as strategic needs.

2. Theoretical background

A research project is a complex work, of mixed, scientific and organizational nature, which requires both professional and managerial competence, the expertise in the project field of the project coordinator and the partners being very important. (Toma *et al.*, 2012, p. 1218; Toma *et al.*, 2016, p. 413). The design and writing of the research project must follow a series of rules that ensure the necessary information for the project evaluators, as well as the basis for the project when it is financed (Toma *et al.*, 2011, p. 2131).

The quality of research projects and the results obtained from their implementation are directly proportional to the scientific and managerial competence of the project director. (Toma, 2011, p. 2127).

A project cannot be seen only as a temporary effort undertaken to create a unique product, service or result. Although the objective is the same, the elements that constitute it develop, and must be seen as a system in which inputs directly determine outputs. The evaluation of the fulfillment of quality criteria and the results obtained must be done, not only at the end of the project, but also throughout its development (Sastoque-Pinilla *et al.*, 2022, p. 16).

Project management is characterized by:

- oriented objectives - objectives without which there would be no specific results that will determine special effects in the project environment;
- oriented change - that is, achieving something that you need but do not have;
- interdisciplinarity - because it requires a wide range of professions and knowledge;
- performance oriented - establishing the most appropriate standards and quality conditions for the products produced by the project;
- oriented control - carefully establishing the quality assurance system to comply with the project schedule;
- reviewing habits and traditions - avoiding the traps specific to outdated and inefficient ways of working.

Research project management refers to the process of planning, organizing, coordinating and controlling the activities involved in carrying out a research project. It includes managing funding sources, preparing the project proposal, managing the associated budget, contracting the project and ensuring its proper administration (UPB-HR Research). Research project management also involves identifying and efficiently using the infrastructures necessary for carrying out research activities (UPB-HR Research).

Research project management is essential for several reasons:

1. Ensures the achievement of project objectives within agreed time, cost and quality conditions. Project management includes planning, organizing, monitoring, controlling and reporting all processes to achieve objectives (Wikipedia);
2. Allows for the efficient management of resources (human, financial, material) allocated to the project. Project management applies knowledge, skills, tools and techniques to project activities (Wikipedia);
3. Facilitates the creation of an effective project team and its coordination (Muntean, 2010, p. 2). Project management includes team-building and leadership for all those involved;
4. Helps identify and manage risks associated with the project. Project management monitors and controls risks to ensure the success of the project;
5. Contributes to innovation and development by applying management knowledge and techniques to research projects. Research projects have a unique character and require specific management.

Depending on the structure of the research teams involved and the resources made available to achieve the goal established by the research projects, they are divided into: a. Scientific research projects carried out by a single researcher or by research teams from a research entity or from

several entities; b. Scientific research projects carried out in institutional consortia, at regional, national or international level (Galea, 2021, p. 46, 20).

Research projects in partnership have emerged as a particular form of interaction between academia and industry. In the last ten to fifteen years, they have received increasing attention in the project portfolio of public and private organizations, as well as in the specialized literature on project management. They present specific challenges, requiring adaptations and adjustments to existing project management approaches (Vom Brocke *et al.*, 2015, p. 1025).

A partnership in the context of research projects is a formal collaboration between two or more entities, such as universities, research institutions or enterprises, to work together on a research project. This partnership involves the establishment of a collaboration contract between the parties, which specifies the responsibilities, objectives, activities, resources involved and contributions of each partner to the project (POS-CCE Applicant Guide, 2010, p. 6).

The principle of "partnership" is essential in collaborative research projects. Research partners should be identified from the early stage of preparing the project proposal, and partners should be able to actively contribute to the preparation of the project application. The research partnership should be equal, for example by ensuring that the project builds on joint activities such as joint fieldwork, joint publications, joint supervision of PhD students, knowledge exchange, etc. A successful research partnership is based on reciprocity, trust, mutual respect and sharing of results.

Participants involved in these partnerships share knowledge, collaborate on project activities, and make joint decisions to achieve the complex project objectives (Vaez-Alaei *et al.*, 2024, p. 10). Partners build and maintain relationships based on trust, credibility, respect, dignity, and transparency (Hoekstra *et al.*, 2020, p. 14).

The management of research projects carried out in partnership involves certain particularities that are essential for their success. Among these we can mention the following:

- collaboration and coordination - the management of research projects in partnership requires close collaboration between all parties involved to ensure effective coordination of activities and the achievement of common objectives;
- detailed planning - detailed project planning is crucial, including clear deadlines, well-defined tasks and appropriately allocated resources for each stage of the research;
- human resource management - building a well-trained and motivated team is essential in the management of research projects in partnership. The efficient allocation of human resources and their management are key aspects;
- effective communication - another crucial aspect is effective communication between all parties involved in the project. Clear and open communication helps to avoid misunderstandings and promptly resolve problems;
- optimal risk management - identifying and managing risks is also essential in the management of research projects in partnership. It is important to anticipate possible obstacles and develop strategies to overcome them.

3. Research methodology

The purpose of the research was to analyze the development in partnership of a research project within the University of Medicine and Pharmacy "Grigore T. Popa" Iași, entitled "Multifunctional platform for optimizing diagnostic and decision-making methods in medical services" - PROMED.

The partners who developed the PROMED project were the following:

- ❖ The coordinator of the PROMED project was IPA SA (CO-P1), a research and development institute in the field of automation, information technology and communications that participated in the implementation of a significant number of research projects within national and international research programs;
- ❖ Partner 2 (P2) - ITC SA has as its main activity research and development in the field of computer technology, information technology and communications, having a very large portfolio of works within national and international research programs;
- ❖ Partner 3 (P3) - Clinical Hospital of Obstetrics and Gynecology "Cuza Voda" Iași is the oldest and largest maternity hospital in Moldova, renowned for the quality of services provided to patients and the specialists working within the hospital, mostly academics.

- ❖ Partner 4 (P4) - University of Medicine and Pharmacy "Grigore T. Popa" Iași is the oldest university in Moldova, renowned nationally and internationally for the quality of university education and research activities in the field of medicine;
- ❖ Partner 5 (P5) - National Institute for Research in Informatics ICI is the largest institute with research and development activity in the field of information technology and has been designated an IT center of excellence in Romania.

The research methods used were as follows:

- ✚ Documentation: we studied the project documents: the applicant's guide, the funding application, the project implementation plan, the collaboration agreement between the partners, the project framework estimate, the progress reports of each stage and the final project report;
- ✚ Interview survey: the interview was in-depth, being conducted with the project director carried out in partnership.

To achieve the purpose of the research, we focused on the following main aspects formulated as specific objectives:

- 1) Objective 1 – O1 – *Highlighting the role of each partner within the research project carried out in partnership;*
- 2) Objective 2 – O2 – *Determining the main difficulties encountered in carrying out the partnership;*
- 3) Objective 3 – O3 – *Formulating recommendations and good practices in carrying out research projects carried out in partnership.*

4. Findings and discussion

The interview is one of the most important qualitative research methods that is used to explore in depth the attitudes, behaviors and experiences of the participants.

A semi-structured interview was conducted with the director of the partnership project in which we wanted to find out details about the project objectives, how the partnership went, the challenges, risks and obstacles he faced during the project implementation, as well as the positive things, the beautiful memories he left with after carrying out this project.

The first question in the interview was: "What was the main objective of the project entitled "Multifunctional platform for optimizing diagnostic and decision-making methods in medical services" PROMED?. The project director answered that the main objective was to use information technologies in order to increase the quality and efficiency of medical services in the context of creating the information space of society.

The second question in the interview was "How did the partnership that implemented the PROMED project go?".

Before answering this question, the project director mentioned that he did not know all the partners responsible. He had collaborated with some of them before, but with others it was the first collaboration in such a research project in partnership. Even though at the beginning of the project things were more difficult to connect, each of the partners coming with their own experiences and ideas regarding what should be done within the project, as the project progressed and the activities were carried out, the predicted results began to appear. Thanks to the numerous meetings that took place and thanks to good communication between the partner teams, a very good collaboration was achieved at the consortium level. Thus, even if the partnership started a little more difficult at the beginning, as the project progressed, the collaboration between partners became very good and thus the objectives and predicted results of the research project carried out in partnership could be achieved.

The next question in the interview was: "What were the main challenges related to the management of the research project carried out in the PROMED partnership?".

The project director mentioned three challenges related to the management of the research project. One of the main challenges was respecting the initial planning of the project activities. Even though sometimes the period of carrying out the activities was longer than that foreseen in the

implementation plan, through good collaboration all the foreseen activities were carried out and at the end of each stage the objectives were met and the forecasted results were delivered. An important role in this direction was played by the project management team, which was made up of people with experience in the management of research projects carried out in partnership.

Another important challenge was related to the acquisitions that took place in the project. This was a major headache in the development of research projects, because, in addition to the fact that very lengthy and time-consuming procedures had to be followed, there were also cases in which the one who won the purchase could no longer honor the order. In these cases, a new purchase procedure was necessary, which delayed the development of some activities provided for in the project implementation plan. By initiating the purchase procedures early, we were able to avoid all the unpleasant things that would have been caused by the administrative impossibility of carrying out the purchases so necessary for the smooth development of the research project carried out in partnership.

A third challenge was related to the changes that occurred in the project implementation teams, the coordinator and the project partners. During the development of the project, there were team members who left the project for various reasons. It was necessary to co-opt new members who had at least the same skills and experience as those who left, in order to carry out the project activities and achieve the expected results.

The third question in the interview was: "How was the communication between the PROMED project partners?"

To this question, the project director said that the partners communicated very well with each other. Each partner who entered this project had their own ideas, skills, experiences and expectations related to the project. Maintaining clear and frequent communication between the project team members, sharing expertise and resources, choosing tools appropriate to the needs and preferences of the partners, recognizing the strengths of the other project participants, led to building trusting relationships between the partners.

The next question in the interview was: "What managerial risks did you identify during the project and how were they managed?"

A first managerial risk identified from the design stage of the PROMED project was the one related to the expertise and experience required by the researchers who were to be part of the project team. In order to completely eliminate this risk, very clear criteria were established that had to be met by researchers who wanted to participate in the project. Based on these criteria, a very rigorous selection of team members of all partners was carried out.

Another risk identified was the incorrect estimation of project activities, duration and costs necessary to implement such a project. To avoid these things, a project implementation plan was drawn up, with the involvement of all project partners' managers, a plan in which all activities carried out within the research project carried out in partnership were detailed.

Another managerial risk identified was that of poor management of project teams. To prevent this, the project director ensured that each team had the necessary skills and that there was good collaboration between the members of the partner teams.

A final question from the interview was: "What were the positive things and what memories and satisfactions did you have from the PROMED partnership research project?"

The project director mentioned the very good collaboration within the consortium. This partnership research project involved diverse teams of specialists from different fields: medicine, information technology, bioeconomy, etc. The collaboration allowed for mutual learning, the exchange of knowledge and new perspectives, thus enriching the experience of all participants.

The second positive thing was that involvement in this project led to the development of new skills and competencies, especially for young researchers who developed their project management skills, teamwork, communication and problem-solving skills. Involvement in such successful partnership research projects brings recognition and increased internal and international visibility for the researchers participating in the project.

Another positive thing was the creation of close professional and personal relationships between the members of the project teams. This was due to the very good collaboration between the project partners' team members.

5. Conclusions

The PROMED project aimed to create a multifunctional platform that would manage medical and administrative data of patients, contributing to early diagnosis, reducing the duration of hospitalization, and easy access to information.

The creation of a multifunctional platform allows collaboration between the three important components of the health system:

- ✓ Patients who will actively participate in the process of informing themselves about their own health;
- ✓ Healthcare providers who will have access to the medical information of their own patients;
- ✓ Public health authorities who will be able to view real-time reports on the health status of the population and will be able to develop prevention and warning plans for citizens in the event of epidemics.

Regarding the management of research projects carried out in partnership, we can draw the following conclusions:

1. A research project is a complex work, of mixed, scientific and organizational nature, which requires both professional and managerial competence. The design and drafting of the research project must follow a series of rules that ensure the necessary information for the project evaluators, as well as the basis for the project when it is funded.
2. A partnership in the context of research projects represents a formal collaboration between two or more entities, such as universities, research institutions or companies, to work together on a research project. This partnership involves the establishment of a collaboration contract between the parties, which specifies the responsibilities, objectives, activities, resources involved and contributions of each partner to the project.
3. Partnerships in research projects bring multiple benefits, including access to resources and diversified expertise, increasing the impact and relevance of the research, reducing costs and risks, promoting collaboration and communication, as well as increasing the credibility and recognition of the project.
4. The management of research projects carried out in partnership requires an integrated approach, which emphasizes collaboration, detailed planning, human resource management, effective communication and risk management to ensure the success of the project.
5. Maintaining clear and frequent communication between project team members, sharing expertise and resources, choosing tools appropriate to the needs and preferences of partners, recognizing the strengths of other project participants, led to the building of trusting relationships between partners.
6. In order to effectively manage the possible risks that may arise in the conduct of a research project carried out in partnership, it is important to develop a detailed risk management plan, which includes the identification, analysis, response planning and monitoring of risks throughout the project.
7. Partnerships in research projects bring multiple benefits, including access to diversified resources and expertise, increasing the impact and relevance of research, reducing costs and risks, promoting collaboration and communication, as well as increasing the credibility and recognition of the project.

For a research project carried out in partnership to be successfully completed, clearly defined objectives are needed, a team with complementary expertise and skills, a very well-prepared project implementation plan, very good communication between partners, and funding that guarantees the achievement of the forecasted results and the achievement of the project objectives.

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A Glimpse into the Worldwide Startup Ecosystems

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Abstract

Since its post-war global spread, entrepreneurial activity has become an important concern of many governments and policymakers. More and more, the economic prosperity of nations has become deeply dependent on entrepreneurs. In order to stimulate startups appearance, there is a need to build an appropriate context. This is why the design, creation and development of startup ecosystems worldwide constitute a key pre-requisite for entrepreneurial success in the age of globalization. The aims of the paper are to define the concept of startup ecosystem and to briefly analyse its evolution at a global level in recent years by using the Global Startup Ecosystem Index. In this line, the author employed a qualitative research method. The findings show that a startup ecosystem constitutes a business agreement among different people and organizations. Also, they demonstrate that the global landscape of startup ecosystems was clearly dominated by the United States of America.

Key words: startup ecosystem, Global Startup Ecosystem Index, United States of America

J.E.L. classification: L26

1. Introduction

Since its post-war global spread, entrepreneurial activity has become an important concern of many governments and policymakers. Entrepreneurship has begun to occupy an increasing higher position on their political agenda. Therefore, „the transition towards start-up ecosystem-based economic growth” (Sipola *et al*, 2016, p.180) constitutes an essential systemic change for any economy.

More and more, the economic prosperity of nations is deeply dependent on entrepreneurs (Toma, 2013; Catană *et al*, 2020; Rong, 2025). In most cases, startups contributed to job creation, social change, innovation and economic growth (Gries *et al*, 2009; Kane, 2010; Fritsch *et al*, 2013).

In order to stimulate startups appearance, there is a need to build an appropriate context (Ojaghi *et al*, 2019). This is why the design, creation and development of startup ecosystems worldwide constitute a key pre-requisite for entrepreneurial success in the age of globalization (Cornescu *et al*, 2004; Toma, 2005). The rapid expansion of new technologies of the Industry 4.0 (Tohănean *et al*, 2018; Toma *et al*, 2018) in all activities and domains increasingly requires high-tech and innovative startup ecosystems (Bala Subrahmanya, 2022).

The objectives of the paper are to explain the concept of startup ecosystem and to analyse its evolution at a global level in recent years by using the Global Startup Ecosystem Index (GSEI). The study is structured in the following way: the second part illustrates the literature review. The research methodology is exhibited in the third section of the study. The fourth part deals with the findings. The conclusions are exhibited at the end of the paper.

2. Literature review

Since its appearance, the concept of startup ecosystem has caught the attention of numerous entrepreneurs, businessmen, investors, policymakers and researchers. A startup ecosystem is defined as:

- „a purposeful business arrangement between two or more entities (the members) to create and share in collective value for a common set of customers. Every business ecosystem has participants, and at least one member acts as the orchestrator of the participants. All members in a business ecosystem, whether orchestrators or participants, have their brands present in the value propositions” (Sarafin, 2021, p.1).
- „the result of the environment within which startups and other supporting players operate in” (StartupBlink, 2023a, p.1).
- „a shared pool of resources, generally located within a 60-mile (100-kilometer) radius around a center point in a given region, with a few exceptions based on local reality. It is typically concentrated around a major city and incorporates what would be considered the metropolitan statistical area” (Wolfgang, 2024, p.1).
- „a dynamic network of people and organizations offering resources that contribute to startup success” (Shopify, 2024, p.1).
- „the interconnected network of individuals, organizations, resources, and support structures that collectively contribute to the growth and success of startups in a particular geographical region or industry” (GeeksforGeeks, 2025, p.1).

The above-mentioned definitions allow the identification of several features of a startup ecosystem as follows:

- There is no universal definition of the concept.
- A startup ecosystem represents a business agreement among various people (e.g., entrepreneurs, angel investors, start-up mentors) and organizations (e.g., incubators, universities, venture capital companies).
- It is often built around a city.
- A startup ecosystem is based on multiple human relationships.
- Entrepreneurs are at the core of a startup ecosystem.
- A startup ecosystem aims at creating new startup companies and jobs, strengthening the relationships among its members, and developing self-sustaining resources networks.
- It involves physical and/or virtual environments.
- A startup ecosystem has the capacity to continuously innovate and build enduring business organizations.
- It is often controlled by both internal (e.g., people diversity, skills) and external (e.g., market disruptions, financial climate) factors.
- A startup ecosystem may interact and collaborate with other startup ecosystems.

In order to assess the startup ecosystems, researchers and practitioners are using the GSEI which is annually calculated at a global scale by StartupBlink, an innovation economy research platform. Each startup ecosystem obtains a total score which encompasses 3 subscores measuring:

- Quantity- it calculates the activity level of an ecosystem.
- Quality- it evaluates the repercussions and success of the ecosystem activity.
- Business environment- it assesses how helpful the general conditions are for startup growth (StartupBlink, 2025).

On its turn, each subscore contains several components (Table no. 1). A strong startup ecosystem imposes the existence besides the startup(s) of a plethora of supportive organizations that contribute with various resources and networking.

Startup ecosystems are mainly relied on entrepreneurs and their startups. In order to cope with an unstable environment (Toma *et al*, 2015; Marinescu *et al*, 2015a), successful entrepreneurs prove a solid strategic thinking (Toma *et al*, 2016a; Toma *et al*, 2016b; Toma, 2023a), design and implement viable business strategies (Toma *et al*, 2013a; Toma *et al*, 2016c; Toma 2024a) and sustainable business models (Toma *et al*, 2012a; Toma *et al*, 2019), are effective and wise leaders (Marinescu *et al*, 2015b; Toma *et al*, 2020a; Toma *et al*, 2020a; Toma, 2024b), possess an entrepreneurial mindset (Marinescu *et al*, 2017a; Grădinaru *et al*, 2018; Zănea *et al*, 2020; Hudea *et al*, 2021), show creativity (Toma *et al*, 2013b; Marinescu *et al*, 2016; Marinescu *et al*, 2017b) and innovativeness (Toma *et al*, 2016d; Grădinaru *et al*, 2023; Tohănean *et al*, 2024), implement lean (Naruo *et al*, 2007; Marinescu *et al*, 2008; Toma *et al*, 2022), agile (Toma, 2023b) and quality management (Toma, 2006; Toma *et al*, 2009; Toma *et al*, 2012b), are socially responsible (Toma, 2008a; Toma *et al*, 2011; Toma, 2012), and use various techniques and methods such as the

balanced scorecard (Toma *et al*, 2010), Six Sigma (Toma, 2008b), marketing mix (Marinescu *et al*, 2010; Grădinaru *et al*, 2017; Catană *et al*, 2021), customer experience (Toma *et al*, 2021a; Toma *et al*, 2021b) and training programs (Toma, 2008c; Marinescu *et al*, 2013).

Table no. 1. The components of the 3 subscores of the Global Startup Ecosystem Index

Quantity	Quality	Business environment
Number of startups	Total accumulated private sector startup investment	Diversity index
Number of investors	Total accumulated number of startup sector employees	Internet speed
Number of coworking spaces	Number and size of unicorns and exits above US\$1 billion (Bn)	Cost of internet
Number of accelerators	The traction of startups in each ecosystem (including traffic, domain authority, and customer base)	Internet freedom
Number of startup-related meetups	R&D centers of multinational technology companies	R&D investment
	Branches of multinational companies and brands	Availability of various technological services (payment portals, ride-sharing apps, cryptocurrency)
	Total accumulated value of exits with a valuation below US\$1Bn	Level of English proficiency
	Number and size of global startup events and conferences	Passport strength
	Presence and impact of Pantheon members (= hundreds of global companies which have a substantial impact on their startup ecosystem and its brand)	Availability of startup or nomad visas
	Presence and impact of Global Startup Influencers	Corporate tax rate
	Number of startups accepted by top global accelerators per ecosystem	Startup-friendliness of labor laws
	Number and market capitalization of listed companies in technology sectors	Corruption perception index
		Peer-reviewed scientific papers
		Sovereign debt credit score
		Top universities per location
		Corporate startup activity per location

Source: (StartupBlink, 2025)

3. Research methodology

The author employed a research methodology based on a qualitative method in order to attain the aims of the paper. Firstly, he searched for the most suitable secondary sources of data. Secondly, the author collected the data and classified them. Thirdly, he analyzed numerous articles, books and reports from several electronic databases. Fourthly, he synthesized the data and elaborated the paper.

4. Findings

This section of the paper focuses on the results of the research. In this respect, the author analyzed the evolution of the GSEI in the period 2023-2025. In 2023, the United States of America dominated the top, followed by the United Kingdom and Israel (Table no. 2). The European countries occupied 50% of the ranking.

Table no. 2. The top 10 country ranking according to the GSEI in 2023

Rank	Country	Total score
1	United States of America	198.080
2	United Kingdom	51.218
3	Israel	46.573
4	Canada	34.490
5	Sweden	27.074
6	Singapore	26.571
7	Germany	25.939
8	France	22.916
9	Australia	21.503
10	The Netherlands	21.423

Source: (StartupBlink, 2023b)

One year later, the first three countries of the top remained the same and kept the previous order (Table no. 3). The number of European countries increased, occupying 60% of the hierarchy.

Table no. 3. The top 10 country ranking according to the GSEI in 2024

Rank	Country	Total score
1	United States of America	215.001
2	United Kingdom	55.995
3	Israel	51.557
4	Canada	38.254
5	Singapore	37.736
6	Sweden	27.024
7	Germany	25.830
8	France	24.894
9	The Netherlands	24.462
10	Switzerland	24.081

Source: (StartupBlink, 2024)

In 2025, nothing changed regarding the order of the first three countries of the top (Table no. 4). Also, The European countries occupied 60% of the ranking.

Table no. 4. The top 10 country ranking according to the GSEI in 2025

Rank	Country	Total score
1	United States of America	254.050
2	United Kingdom	70.743
3	Israel	62.167
4	Singapore	54.682
5	Canada	45.438
6	Sweden	35.311
7	Germany	33.159
8	France	32.417
9	Switzerland	31.747
10	The Netherlands	30.872

Source: (StartupBlink, 2025)

The above-mentioned outcomes enable the emphasis of the following issues for the period 2023-2025:

- The United States of America dominated by far the top of the first ten countries according to the GSEI in that period.
- In those three consecutive years, the first three countries of the top (United States of America, United Kingdom, Israel) kept their position.
- That period witnessed the clear predominance of the European countries in the ranking.
- Switzerland succeeded to enter the top of the first ten countries in 2024 while Singapore increased steadily its performance.
- The top 10 country ranking according to the GSEI did not suffer major variations during the period.

5. Conclusions

Since its emergence, the startup ecosystem has become a theme of interest for numerous policymaking, researchers and entrepreneurs. Its important contribution to job creation and economic growth has convinced governments around the world to impose it as a priority on their political agenda.

The paper illustrates the complexity of the startup ecosystem concept, outlining some of its characteristics. It shows that a startup ecosystem constitutes a business agreement among different people and organizations which puts at its core the entrepreneurs. Also, this study demonstrates that in the period 2023-2025 the global landscape of startup ecosystems was clearly dominated by the United States of America. Further research may concentrate on the relationships among startup ecosystems worldwide.

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Analyzing the Evolution of the Biggest Companies Operating in Romania during the COVID-19 Pandemic

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Abstract

Since their emergence, companies have played all over the world an important role in the economic activity of countries. The numerous changes they have produced were of a great magnitude and led to profound transformations in human society. As key institutions under modernity and postmodernity eras, companies have represented high influential agents of change and significant wealth generators. The paper aims at briefly defining the concept of company and analyzing the evolution of the biggest companies operating in Romania during the COVID-19 pandemic, in terms of their turnover. The author used a research methodology based on a qualitative scientific method to achieve the purposes of the study. The findings show that big foreign companies obviously dominated the top of the 10 biggest companies operating in Romania by their turnover. OMV Petrom, a company from the petroleum industry and distribution, was the leader in three out of four years.

Key words: company, turnover, Romania, OMV Petrom

J.E.L. classification: L29, M00

1. Introduction

Since their emergence, the companies have played all over the world an important role in the economic activity of countries. The numerous changes they have produced were of a great magnitude and led to profound transformations in the human society. As key institutions under modernity and postmodernity eras, companies have represented high influential agents of change and significant wealth generators.

Since the Fall of the Berlin Wall, the worldwide spread of the globalization process has allowed companies, especially multinational and transnational, to penetrate and conquer new countries and markets (Cornescu *et al*, 2004; Toma, 2005). This was also the case of Romania, a former European ex-communist country.

The 1990s brought the first signs of the transformation of the Romanian economy: gradual retreat of the state from the economy, privatization, liberalization and free competition. In those years there was a common consent that the future of Romania should be based on a multipartinic democracy and a market economy (Dăianu *et al*, 2013). Consequently, the Romanian economy opened towards free trade and international investments (World Bank, 2020).

The changing economic landscape of Romania led to the emergence of a Romanian entrepreneurialism and, therefore, a plethora of small- and medium-sized enterprises (SMEs) were created (Gheorghe *et al*, 2024). On the other hand, foreign companies entered the Romanian market and provided new goods and services. Unfortunately, the COVID-19 pandemic period determined the disappearance of many businesses.

The paper aims at briefly defining the concept of company and analyzing the evolution of the biggest companies operating in Romania (in terms of their turnover) during the COVID-19 pandemic. This structure of this study is the following: the second chapter deals with the literature review. The research methodology is shown in the third chapter of the paper. The fourth chapter exhibits the findings. Conclusions are illustrated at the end of the study.

2. Literature review

Since its emergence, the term of company has become a subject of interest for numerous academics, businessmen and policymakers. A company is defined as:

- „an organization that sells goods or services in order to make money” (Cambridge Dictionary, 2025, p.1).
- „a legal entity formed by one or more individuals to engage in business” (Hayes, 2025, p.1).
- „a group of people who have joined together for a certain purpose with a more or less permanent character” (LexisNexis, 2025, p.1).
- „a voluntary association of individuals, having a common purpose, who agree to pool their funds and unite to achieve the said goals” (GeeksforGeeks, 2025, p.1).
- „a business organization that makes, buys, or sells goods or provides services in exchange for money” (Encyclopædia Britannica, 2025, p.1).
- „a business organization that makes money by selling goods or services”/ „a group associated for some purpose, as to form a commercial or industrial firm” (Collins Dictionary, 2025, p.1).

These definitions lead to the pinpointing of several characteristics of a company as follows:

- o There isn't an agreed-upon definition of the concept.
- o A company represents a business organization.
- o It constitutes a separate legal entity composed by one or more people.
- o A company aims at making money through selling goods and/or providing services.
- o It gathers individuals which have common business purposes.
- o A company requires the compliance with the laws.

In sum, a company concerns one or more individuals who carry on commercial activities to earn money. Most companies are either limited liability companies or joint-stock companies.

To face the challenges of an unstable business environment (Toma, 2013; Toma *et al*, 2015; Marinescu *et al*, 2015a), today's successful companies need enlightened leadership (Marinescu *et al*, 2015b; Toma *et al*, 2020a; Toma *et al*, 2020b; Toma, 2024b) and deep strategic thinking (Toma *et al*, 2016a; Toma *et al*, 2016b; Toma, 2023a), have to create and put in practice effective corporate and business strategies (Toma *et al*, 2013a; Toma *et al*, 2016c; Toma 2024a) combined with enduring business models (Toma *et al*, 2012a; Toma *et al*, 2018a; Toma *et al*, 2019), promote entrepreneurial spirit (Marinescu *et al*, 2017a; Grădinaru *et al*, 2018; Hudea *et al*, 2021) alongside with vivid creativity (Toma *et al*, 2013b; Marinescu *et al*, 2017b; Marinescu *et al*, 2016), innovativeness (Toma *et al*, 2016d; Tohănean *et al*, 2018; Grădinaru *et al*, 2023; Tohănean *et al*, 2024) and hard-working (Catană *et al*, 2020), apply agile (Toma, 2023b) and lean (Naruo *et al*, 2007; Marinescu *et al*, 2008; Toma *et al*, 2022) management mostly based on quality principles (Toma, 2006; Toma *et al*, 2009; Toma *et al*, 2012b), nurture social corporate responsibility (Toma, 2008a; Toma *et al*, 2011; Toma, 2012) and utilize specific methods like marketing mix (Marinescu *et al*, 2010; Grădinaru *et al*, 2017; Toma *et al*, 2018; Catană *et al*, 2021), Six Sigma (Toma, 2008b), customer experience (Toma *et al*, 2021a; Toma *et al*, 2021b), training programs (Toma, 2008c; Marinescu *et al*, 2013) and balanced scorecard (Toma *et al*, 2010)

The Romanian business landscape is dominated by multinational and transnational corporations such as OMV Group, Erste Group and Renault Group. They are operating alongside with numerous local SMEs.

3. Research methodology

The author used a research methodology based on a qualitative scientific method in order to achieve the aims of the paper. First, he identified the needed secondary sources of data through searching in several electronic databases. Second, the author gathered and classified the information. Afterwards, a comprehensive literature review allowed him to synthesize the data. At the end, the author analyzed the information and elaborated the study.

4. Findings

This chapter of the study illustrates the results of the research. On this line, the author analyzed the evolution of the biggest companies operating in Romania in terms of their turnover in the period 2020-2023. In the first year of the COVID-19 pandemic period, Automobile-Dacia SA dominated the top, being followed by OMV Petrom SA and OMV Petrom Marketing SRL (Table no. 1). As a member of Renault Group (France), the automaker Automobile-Dacia SA is located in the city of Mioveni, Argeş county. Its turnover surpassed 18 million (M) lei in 2020.

Table no. 1. The top 10 largest companies operating in Romania by turnover in 2020

Rank	Company	Turnover (Mlei/RON)
1	Automobile-Dacia SA	18,299
2	OMV Petrom SA	14,795.5
3	OMV Petrom Marketing SRL	14,519.7
4	Lidl Discount SRL	12,863
5	Kaufland România SCS	12,835
6	Ford România	12,377.9
7	British American Tobacco Trading SRL	11,367.8
8	Rompetrol Downstream SRL	9,274.6
9	Dedeman SRL	9,082
10	Carrefour România SA	9,019.1

Source: (Ciriperu, 2022)

The period 2021-2023 witnessed the clear domination of OMV Petrom SA (Tables no. 2, 3 and 4). The company is located in Bucharest, the capital of Romania, and is part of OMV Group (Austria).

Table no. 2. The top 10 largest companies operating in Romania by turnover in 2021

Rank	Company	Turnover (Mlei/RON)
1	OMV Petrom SA	23,586
2	Automobile-Dacia SA	21,442
3	OMV Petrom Marketing SRL	18,913
4	Lidl Discount SRL	14,877
5	Kaufland România SCS	13,967
6	Rompetrol Downstream SRL	12,244
7	Rompetrol Rafinare SA	12,150
8	British American Tobacco Trading SRL	12,096
9	Ford Otosan România SRL	11,519
10	Dedeman SRL	10,038

Source: (Ciriperu, 2023)

Table no. 3. The top 10 largest companies operating in Romania by turnover in 2022

Rank	Company	Turnover (Mlei/RON)
1	OMV Petrom SA	55,940
2	OMV Petrom Marketing SRL	27,047
3	Automobile-Dacia SA	25,709
4	Rompetrol Rafinare SA	23,027
5	Lidl Discount SRL	18,496
6	Rompetrol Downstream SRL	16,572
7	Kaufland România SCS	16,014
8	Engie România SA	15,191
9	Ford Otosan România SRL	13,906
10	E.on Energie România SA	13,725

Source: (Ciriperu, 2024)

Table no. 4. The top 10 largest companies operating in Romania by turnover in 2023

Rank	Company	Turnover (Mlei/RON)
1	OMV Petrom SA	33,828
2	Automobile-Dacia SA	26,011
3	OMV Petrom Marketing SRL	23,038
4	Lidl Discount SRL	21,767
5	Kaufland România SCS	18,346
6	Rompetrol Rafinare SA	17,121
7	Rompetrol Downstream SRL	14,431
8	Ford Otosan România SRL	13,667
9	Profi Rom Food SRL	12,926
10	Hidroelectrica	12,342

Source: (Ciriperu, 2025)

The above-mentioned findings allow the outline of the following issues for the COVID-19 period:

- Big foreign companies obviously dominated the top of the 10 largest companies operating in Romania by turnover.
- The retail sector controlled the hierarchy.
- Seven companies (OMV Petrom Marketing, Rompetrol Downstream, Kaufland România, Lidl Discount, Dedeman, Carrefour România, Profi Rom Food) were from the retailing sector.
- Three companies (Automobile-Dacia, Ford România, Ford Otosan România) were from the automotive industry.
- Three companies (Engie România, E.on Energie România, Hidroelectrica) were from the energy sector and distribution.
- Two companies (OMV Petrom, Rompetrol Rafinare) were from the petroleum refining industry and distribution.
- One company (British American Tobacco Trading) was from the tobacco industry

5. Conclusions

Since the collapse of its communist regime at the end of 1989, the Romanian economy underwent dramatic changes. It has gradually transformed from a centrally planned economy into a market economy. Therefore, numerous private companies both local and foreign started to open their businesses in Romania.

The study defines the concept of a company and enumerates some of its features. It also analyzes how the biggest companies operating in Romania evolved during the COVID-19 pandemic period, in terms of their turnover. In this respect, foreign companies clearly led the top of the 10 largest companies acting in Romania. Three out of four years, OMV Petrom occupied the dominant position. Further research may consider other key indicators, such as profit and number of employees.

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Digital Transformation in Hospitality Services: Conceptual Framework and Managerial Implications

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Abstract

Digital transformation has become a defining factor in the evolution of hospitality services, reshaping operational models, customer interaction and value creation processes. This paper presents a conceptual framework that synthesizes the main theories and models relevant to digitalization in the hospitality industry. Emphasis is placed on the strategic and managerial implications of adopting digital tools, ranging from automation and AI integration to data-driven decision-making. The study also addresses the challenges posed by organizational change and resistance to technology. By exploring the literature on digital transformation and hospitality, the paper highlights the need for an adaptive and innovation-oriented management approach in order to remain competitive in an increasingly digitalized market.

Key words: Digital transformation, hospitality industry, conceptual model, strategic management, innovation

J.E.L. classification: L83, L86, M10, O32

1. Introduction

The hospitality industry is undergoing a profound transformation driven by the accelerated adoption of digital technologies. Innovations such as mobile check-in, AI-powered personalization, cloud-based property management systems, and Internet of Things (IoT) integration are reshaping both the customer experience and back-office operations. Digital transformation in this sector is no longer optional but has become a strategic imperative in order to remain competitive in a dynamic global market (Buhalis & Leung, 2018).

Beyond technological upgrades, digital transformation involves a comprehensive shift in organizational mindset, business models and managerial practices. In this context, hospitality managers are increasingly required to adopt agile decision-making processes, develop digital leadership capabilities, and align technology implementation with customer-centric strategies (Morosan & DeFranco, 2016).

Recent studies emphasize that digital transformation should be viewed as a socio-technical process that integrates technological infrastructure, organizational capabilities and human resource adaptation (Verhoef et al., 2021). However, the existing literature remains fragmented, with a significant focus on isolated technologies or operational outcomes, rather than on strategic and managerial implications in a holistic manner.

Therefore, the purpose of this paper is to develop a conceptual framework that synthesizes current theoretical contributions and provides an integrated perspective on the managerial implications of digital transformation in hospitality services. The framework proposed aims to support academics

and practitioners alike in understanding how digital transformation influences organizational performance, strategic orientation, and innovation capacity in the hospitality sector.

2. Literature review

Digital transformation (DT) is generally defined as the integration of digital technologies into all aspects of business, resulting in fundamental changes in operations, service delivery, customer relationships, and value creation (Verhoef et al., 2021). Unlike digitization (conversion of analog data into digital format) or digitalization (using digital technologies to improve processes), DT implies a more radical and strategic shift, with long-term organizational consequences.

In hospitality, DT is shaped by the sector's dual nature—technology-intensive and service-oriented—which creates both opportunities and challenges for implementation. The adoption of technologies such as mobile apps, artificial intelligence, smart rooms, and customer analytics tools must be accompanied by organizational restructuring, workforce development, and cultural openness to innovation (Buhalis & Leung, 2018). Thus, DT in hospitality is not merely a technical matter, but an organizational transformation embedded in strategic goals.

The hospitality literature integrates several well-established theoretical models to analyze digital adoption and transformation. Among the most relevant are:

- Technology Acceptance Model (TAM): Introduced by Davis (1989), TAM emphasizes *perceived usefulness* and *perceived ease of use* as key predictors of technology adoption. It has been widely used in hospitality to evaluate employee and customer willingness to adopt innovations such as mobile check-in, self-service kiosks, or digital concierge apps (Kim et al., 2008).
- Unified Theory of Acceptance and Use of Technology (UTAUT / UTAUT2): This model extends TAM by adding variables such as *social influence*, *facilitating conditions*, and *hedonic motivation*. UTAUT has been used to explain adoption of NFC mobile payments in hotels, smart locks, and virtual guest assistants (Morosan & DeFranco, 2016).
- Technology–Organization–Environment (TOE) Framework: TOE posits that adoption is determined by three contexts: *technological* (e.g., compatibility, complexity), *organizational* (e.g., size, structure, culture), and *environmental* (e.g., competition, regulation). It has proven especially useful in explaining the broader managerial and strategic conditions influencing transformation in hotel chains (Tornatzky & Fleischer, 1990).
- Dynamic Capabilities Theory: This perspective focuses on a firm's ability to integrate, build and reconfigure internal and external competences to address rapidly changing environments. It offers a more advanced view of DT, emphasizing the development of organizational learning, sensing, and transformation capabilities (Teece, 2007).

These models provide complementary lenses through which the complexity of DT in hospitality can be better understood, particularly when evaluating not just *if* technologies are adopted, but *how* they are strategically embedded and sustained.

Recent studies have highlighted a wide range of digital innovations reshaping hospitality services. These can be grouped into:

- Guest-facing technologies: including online booking engines, chatbots, digital room keys, smart TVs, virtual reality (VR) tours, and AI-driven personalization of services. These tools enhance customer experience and engagement (Bilgihan et al., 2016).
- Operational technologies: such as energy management systems, predictive maintenance software, automated inventory control, and integrated PMS. These increase efficiency and sustainability.
- Analytical tools: using big data and machine learning to forecast demand, optimize pricing (revenue management), and personalize marketing campaigns (Li et al., 2020).

However, the literature also cautions that technological fragmentation and lack of staff training can hinder the effectiveness of these innovations, particularly in small and medium-sized hospitality enterprises (SMEs), which often lack the resources and strategic capabilities for coherent digital integration (Mariani & Borghi, 2019).

Despite the growing body of work on digital innovation, several gaps persist in the literature:

- Most studies are technology-centric, focusing on the impact of individual tools or systems, with limited integration of organizational and strategic dimensions.
- There is a lack of unified frameworks that connect digital capabilities with leadership, cultural change, and long-term performance in hospitality settings.
- Empirical studies often concentrate on large hotel chains, leaving SMEs underexplored, although they represent the majority of the hospitality landscape in many countries.
- The post-pandemic literature has expanded focus on contactless technology, yet there is insufficient exploration of *transformational leadership*, *employee engagement*, and *organizational resilience* in digital contexts.

In light of these gaps, the present paper proposes a conceptual synthesis that integrates the technological, organizational and strategic-managerial perspectives of DT into a coherent model tailored to the realities of the hospitality sector.

3. Research methodology

This article employs a qualitative and conceptual research methodology, grounded in an in-depth review of academic literature sourced exclusively from the Scopus database. The aim of the research is to develop a comprehensive conceptual framework that synthesizes the main theoretical contributions on digital transformation and identifies key managerial implications for the hospitality sector.

The literature review was conducted between March and May 2025 and focused on academic journal articles published between 2010 and 2024. The search was limited to full-text articles written in English, with the following keywords: "*digital transformation*", "*hospitality industry*", "*strategic management*", "*technology adoption*", "*innovation in services*". A total of 55 articles were selected based on their relevance, frequency of citation, and contribution to the topic.

The selected studies were analyzed thematically, identifying conceptual patterns and key constructs such as technological drivers, organizational change, managerial adaptation, and customer experience enhancement. These elements were then integrated into a theoretical framework that seeks to clarify the mechanisms through which digital transformation influences strategic decisions and service delivery in hospitality organizations.

While the paper does not include empirical data, it offers a foundation for future studies and provides a structured lens through which hospitality managers and researchers can understand digital transformation from a strategic perspective.

4. Findings

The hospitality industry is uniquely positioned at the intersection of technology and personalized service delivery, making digital transformation both an opportunity and a challenge. The review of literature reveals that the transformation process in this sector unfolds along three core dimensions, each with distinct managerial implications:

- **Technological dimension:** Refers to the integration of digital tools such as Artificial Intelligence (AI), Internet of Things (IoT), big data analytics, and cloud-based systems. These technologies automate core operations (e.g., check-in/out, billing, housekeeping), enable hyper-personalized guest experiences, and facilitate remote management (Buhalis & Leung, 2018). However, their successful deployment requires not only financial investment but also a deep understanding of user experience and system interoperability.
- **Organizational dimension:** Encompasses structural and cultural shifts within the company. This includes process reengineering, agile decision-making, cross-functional collaboration, and employee upskilling. Organizational resistance to change, lack of digital skills, and bureaucratic inertia are cited as major barriers to transformation (Tajeddini et al., 2020). Organizations that foster a digital culture—where innovation, experimentation, and learning are encouraged—tend to perform better in implementing new technologies.

- Strategic leadership dimension: A consistent finding in the literature is the central role of leadership in shaping transformation. Leaders must articulate a clear vision, align resources, support experimentation, and guide the organization through uncertainty (Verhoef et al., 2021). Leadership commitment and strategic alignment are considered critical success factors in translating digital investments into performance gains.

These dimensions are not linear or isolated. Instead, they interact in a recursive and dynamic manner, which the conceptual model proposed in this paper aims to reflect.

Achieving meaningful digital transformation in hospitality requires managers to activate a set of interrelated strategic levers, which function as mechanisms of change and alignment. The literature suggests the following as particularly influential:

- Digital vision and strategic alignment: Managers must articulate a clear digital vision and ensure that digital initiatives are not siloed within IT departments, but are integrated into the overall business strategy (Morosan & DeFranco, 2016). This includes setting digital KPIs, redefining customer journeys, and aligning organizational incentives.
- Organizational agility: Rapid adaptation to technological and market changes is essential in hospitality. Agile organizations adopt iterative development approaches, enable cross-departmental collaboration, and decentralize decision-making. This is especially important in times of crisis, such as the COVID-19 pandemic, where hotels had to shift rapidly toward contactless technologies (Sharma et al., 2021).
- Talent development and digital competence: A digitally skilled workforce is indispensable. Training programs, recruitment strategies focused on digital literacy, and knowledge-sharing platforms are essential to building long-term capabilities. Moreover, employee engagement and motivation are critical to overcoming resistance and ensuring adoption.
- Customer-centric innovation: Using guest data to personalize services, anticipate needs, and design responsive experiences is becoming a competitive necessity. This includes the use of CRM systems, real-time feedback loops, and AI-based recommendation engines (Sigala, 2018).

When these levers are strategically managed and interlinked, they create the necessary conditions for successful and sustainable digital transformation.

Drawing on the dimensions and levers identified, a conceptual framework is proposed to structure the digital transformation process in hospitality. The framework is designed to be both descriptive and prescriptive, highlighting the key areas that must be addressed simultaneously for performance improvements to occur.

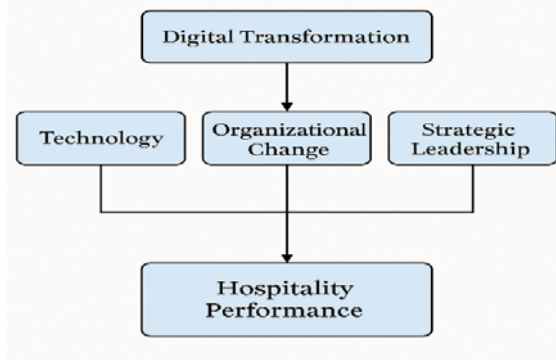
As depicted in Figure no. 1, digital transformation serves as the initiating force, catalyzing changes across three key domains:

1. Technology – the digital enabler
2. Organizational Change – the internal mechanism of adaptation
3. Strategic Leadership – the guiding force and integrator

These domains operate in interdependence and converge toward a central outcome: hospitality performance. Performance is viewed broadly here to include operational efficiency, customer satisfaction, innovation capability, and long-term competitiveness.

The model assumes that none of the components alone can generate sustainable transformation. Instead, performance results when the organization achieves a systemic balance between technological advancement, organizational readiness, and managerial alignment.

Figure no. 1. Conceptual framework of digital transformation in hospitality



Source: author's own elaboration based on literature synthesis (2025)

The proposed framework offers several implications for both research and managerial practice.

From a theoretical perspective, the model contributes by integrating fragmented literature on technology adoption, strategic management, and organizational change into a unified perspective specific to hospitality. It can serve as a conceptual basis for future empirical research, including structural equation modeling, qualitative case studies, or Delphi expert studies.

From a managerial perspective, the model provides a practical roadmap. Managers can use it as a diagnostic and planning tool, assessing their organization's current state in each domain and identifying gaps in digital maturity. For example, an advanced technology infrastructure will not yield results unless accompanied by organizational change and top management support.

Moreover, the model highlights the importance of orchestration. It is not sufficient to invest in digital systems; transformation must be strategically led, culturally supported, and operationally embedded across all levels of the organization.

Finally, this conceptualization encourages hospitality leaders to move away from reactive digitalization and adopt a proactive, future-oriented strategic mindset.

5. Conclusions

This paper explored the theoretical foundations and managerial implications of digital transformation in the hospitality industry. By conducting an extensive literature review based solely on peer-reviewed sources from the Scopus database, a conceptual framework was developed that integrates technological innovation, organizational change, and strategic leadership into a unified model.

The findings emphasize that digital transformation in hospitality is not a linear process, nor one that can be achieved through technology alone. Instead, it is a multidimensional phenomenon requiring alignment across three key domains: the adoption of smart technologies, the restructuring of internal processes and human capital, and the articulation of a coherent digital vision by top management. Each of these components is necessary but not sufficient in isolation. Their interdependence defines the depth and sustainability of transformation efforts.

From a theoretical perspective, this study contributes by:

- Synthesizing fragmented approaches into a comprehensive, conceptually grounded model.
- Bridging technology adoption theories (TAM, TOE, UTAUT) with organizational and leadership theories (dynamic capabilities, change management) in the context of hospitality.
- Highlighting research gaps, particularly the lack of integrated models that connect operational technology with managerial behavior and performance outcomes.

The proposed conceptual framework may serve as a foundation for future empirical investigations, including structural equation modeling (SEM), longitudinal case studies, or comparative industry benchmarking.

The proposed model offers several actionable insights for hospitality professionals:

- Managers should prioritize strategic coherence in digital initiatives by embedding them into long-term planning and leadership structures.

- Investment in digital infrastructure must be accompanied by organizational learning, upskilling of staff, and the creation of a culture of innovation.
- Decision-makers should view digital transformation not as an IT project, but as a core strategic capability that affects all layers of the business.
- Regular assessments of digital maturity and change readiness are necessary to monitor progress and identify bottlenecks.

While the conceptual framework presented is grounded in robust theoretical analysis, it has several limitations. First, the paper does not include empirical validation of the proposed relationships. Second, it is limited to sources indexed in Scopus, which may omit emerging practitioner perspectives or grey literature relevant to SMEs.

Future research could address these limitations by:

- Testing the model empirically using data from hotel chains, independent resorts, or booking platforms.
- Expanding the framework to include customer and employee perspectives, particularly concerning digital experience and service satisfaction.
- Exploring post-pandemic dynamics, such as the role of hybrid services (digital + human) and resilience strategies in hospitality operations.

In conclusion, digital transformation in hospitality is not simply a trend but a structural shift in the way services are conceived, delivered, and managed. It requires coordinated action across technology, people, and strategy. By offering a theoretically grounded conceptual framework, this paper contributes to a deeper understanding of how hospitality organizations can strategically navigate the digital age.

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Smart Tourism and Digital Experience: Tools, Platforms and User Preferences in the Post-COVID Context

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Abstract

The COVID-19 pandemic accelerated the digitalization of tourism and led to the development of smart tourism practices. This paper explores the relationship between smart tourism tools, digital platforms, and user preferences in the post-pandemic context. Based on a comparative literature analysis, we identify the main technologies adopted in the tourism sector, the shift in digital user behavior, and the emerging expectations of tourists. The findings highlight the increasing importance of mobile apps, real-time personalization, and immersive digital experiences in shaping destination competitiveness. Practical implications are formulated for tourism stakeholders aiming to enhance digital experience and resilience through smart tourism strategies.

Key words: Smart tourism; digital experience; user preferences; mobile platforms; post-COVID travel

J.E.L. classification: D83, L83, M10, O33

1. Introduction

The COVID-19 pandemic has profoundly impacted the global tourism industry, disrupting mobility and consumer behavior while simultaneously accelerating the integration of digital technologies across all stages of the tourist experience. As travel resumed, the need for contactless interactions, real-time updates, and flexible service provision led to a transformation of traditional tourism systems into digital-first, user-centric environments. In this new reality, the concept of *smart tourism* has emerged as a response to the demand for innovation, safety, personalization, and sustainability (Gretzel et al., 2015).

Smart tourism refers to the strategic integration of advanced technologies such as artificial intelligence (AI), big data, Internet of Things (IoT), mobile applications, augmented reality (AR), and virtual reality (VR) into tourism management and service delivery (Buhalis and Amaranggana, 2015). These tools enable destinations and businesses to design more efficient, adaptive, and engaging tourism experiences. Moreover, smart tourism relies on data flows and digital infrastructure to provide tourists with dynamic access to information, recommendations, and personalized content in real time (Neidhardt et al., 2015).

In the post-COVID context, digital experience has become a key factor of competitiveness, as tourists increasingly value technological fluency, digital convenience, and tailored services (Koo et al., 2016). The expectations of travelers have shifted toward smart environments that combine physical and virtual experiences, integrated platforms, and digital transparency. These new expectations require not only the deployment of technology but also a transformation in the way tourism destinations and businesses engage with users.

This paper investigates the interaction between smart tourism tools and user preferences in the post-pandemic environment. It aims to:

- identify and classify the main digital tools and platforms used in smart tourism;
- analyze current user behaviors and expectations regarding digital experiences;
- compare digital readiness and smart tourism strategies in selected destinations;
- offer practical recommendations for tourism stakeholders seeking to enhance user satisfaction through innovation.

2. Literature review

The evolution from digital tourism to smart tourism reflects a fundamental shift in how technology is integrated into the tourism value chain. While digital tourism primarily referred to the use of internet-based tools to facilitate travel planning and booking, smart tourism goes further by incorporating advanced technologies that enable personalized, context-aware, and real-time services (Gretzel et al., 2015).

According to Buhalis and Amaranggana (2015), smart tourism is characterized by the synergy between digital ecosystems and physical infrastructures, where data collected from tourists, devices, and destinations are processed to generate intelligent services. These services are aimed at improving tourist satisfaction, resource efficiency, and destination management.

Smart tourism is part of the broader concept of *smart cities*, benefiting from developments in data science, mobile computing, and sensor technologies (Yoo et al., 2017). Destinations that embrace this model are often referred to as *smart destinations*, defined by their capacity to collect, process, and respond to data in ways that enhance the tourist journey.

The key dimensions of smart tourism include:

- Smart accessibility: the ability to access information and services anytime, anywhere;
- Smart sustainability: using technology to manage resources responsibly;
- Smart engagement: enabling interaction between users and tourism systems in real time;
- Smart personalization: tailoring services based on user preferences and behavior patterns (Schroeder et al., 2021).

This conceptual framework serves as a foundation for analyzing both technological innovations and the behavioral responses of tourists in a rapidly digitalized world.

The rapid advancement of digital technologies has redefined how tourism services are produced, delivered, and consumed. In the context of smart tourism, digital tools are not only support instruments but central elements that enable real-time interaction, adaptive service design, and dynamic content distribution (Neuhofer et al., 2015).

The most widely used categories of digital tools in tourism include:

- Mobile applications: Used for reservations, itinerary planning, navigation, local recommendations, and customer service. Apps such as Visit A City or TripIt integrate real-time data and push notifications, providing dynamic interaction with tourists (Wang et al., 2022).
- Online booking platforms: Websites and mobile interfaces such as Booking.com, Airbnb, and Expedia allow for instant booking and customization. Many of these platforms use AI algorithms to suggest accommodations and services based on past user behavior and preferences (Li et al., 2020).
- Augmented and Virtual Reality (AR/VR): These technologies are increasingly adopted to provide immersive pre-travel experiences or enhance on-site interpretation in museums and cultural heritage sites. For example, VR applications allow virtual site visits, while AR tools offer enriched navigation and storytelling (Tussyadiah et al., 2018).
- Big data and analytics platforms: Data collected through sensors, social media, and mobile devices are processed to monitor tourist flows, predict trends, and improve destination management. Cities such as Barcelona or Seoul have implemented smart systems that collect data to optimize tourist capacity and resource allocation (Koo et al., 2016).

- Social media platforms: Tourists use platforms like Instagram, TikTok, and Facebook to share experiences, access peer reviews, and interact with destination brands. These platforms serve both as sources of inspiration and as tools for co-creating the tourism experience (Sigala, 2017).

The integration of these tools within a cohesive digital infrastructure contributes to seamless tourism experiences, enhancing the perception of service quality and increasing user satisfaction. The success of these tools depends on both their technical functionality and the level of digital literacy and trust among tourists.

Moreover, the role of interoperability and data privacy regulations, such as GDPR in Europe, has become increasingly relevant, influencing how tourism businesses design their digital platforms and communicate with users (Buhalis and Sinarta, 2019).

The COVID-19 pandemic has caused a profound transformation in tourist behavior, especially in how individuals interact with digital environments before, during, and after travel. Lockdowns, health concerns, and travel restrictions have intensified the reliance on technology as a mediator of safety, convenience, and trust in tourism services (Baum and Hai, 2020).

One of the most significant shifts has been the rise in demand for contactless technologies. Tools such as digital check-ins, QR code-based menus, voice-activated room controls, and contactless payment systems have become standard in many accommodations and service facilities (Shin and Kang, 2021). These changes are driven by the need to reduce physical contact and perceived health risks.

Another change relates to the expectation of real-time information. Tourists now rely heavily on mobile apps and official platforms to access live updates regarding travel restrictions, local COVID-19 incidence, open/closed attractions, or crowd levels at popular sites (Liu et al., 2022). Flexibility and transparency are considered essential components of digital trust.

At the same time, personalization has gained increasing value. Post-COVID travelers prefer platforms that provide tailored suggestions based on interests, behavior, and location. AI-driven platforms use machine learning to recommend destinations, itineraries, and services dynamically, enhancing the sense of control and relevance for users (Ivanov et al., 2020).

Digital well-being has also become a concern. As digital fatigue increased during the pandemic, some tourists now seek a balance between digital convenience and authentic, in-person experiences. As a result, platforms promoting slow travel, local interaction, and low-impact tourism have gained popularity, indicating a shift toward more meaningful, value-driven travel behaviors (Gretzel et al., 2021).

Finally, tourists have become more proactive in managing their digital identities and data privacy. The increased use of health apps, digital travel passes, and tracking tools has triggered new debates on ethical boundaries and transparency, particularly regarding data ownership and third-party use (Xiang et al., 2021).

Overall, the pandemic has produced a more digitally mature and demanding tourist profile, characterized by expectations for intuitive technology, immediate support, and integrated digital ecosystems. These behavioral changes present both opportunities and challenges for destinations transitioning toward smart tourism.

While smart tourism presents numerous benefits—ranging from improved efficiency and personalization to sustainability and competitiveness—its implementation across destinations remains uneven and faces several structural and operational challenges.

One of the most cited barriers is the unequal digital infrastructure across countries and regions. Developing or rural destinations often lack access to high-speed internet, reliable mobile coverage, and integrated data systems, which prevents them from fully adopting smart tourism tools (Gretzel et al., 2015). Even in technologically advanced countries, the adoption rate varies considerably depending on governance, investment, and public-private cooperation (Baggio and Del Chiappa).

Another key challenge is digital fragmentation. The tourism industry is composed of a multitude of small and medium-sized enterprises (SMEs), many of which operate independently and with limited digital capabilities. Without interoperability and standardized platforms, the smart tourism ecosystem may become disjointed, affecting user experience and data coherence (Koo et al., 2016).

The human factor also remains crucial. Even with technological tools in place, success depends on the digital literacy of both service providers and tourists. Training, adaptation, and user-centric design are essential for ensuring that smart tools are effectively used and accepted (Yoo et al., 2017).

Despite these challenges, the post-COVID context has opened significant opportunities for innovation. The widespread adoption of mobile technologies and the normalization of digital interactions have created a more receptive user base for smart tourism solutions. Moreover, data-driven decision-making and predictive analytics offer destinations the ability to optimize visitor flows, reduce environmental pressure, and enhance safety and responsiveness in real time (Li et al., 2020).

Public institutions also play a growing role in supporting smart tourism through strategic plans, funding, and regulatory frameworks. Initiatives such as the European Commission's Digital Europe Programme or the UNWTO Smart Destinations Network facilitate knowledge transfer, benchmarking, and capacity building.

In summary, the implementation of smart tourism is a complex but achievable objective, contingent upon digital infrastructure, cross-sector collaboration, user engagement, and strategic vision. As destinations strive to rebuild tourism in a more sustainable and resilient manner, the smart tourism paradigm offers a valuable roadmap.

3. Research methodology

This paper employs a qualitative, comparative case study methodology to investigate how four European cities—Amsterdam (Netherlands), Dubrovnik (Croatia), Cluj-Napoca (Romania), and Helsinki (Finland)—have implemented smart tourism tools and how these digital solutions align with user preferences in the post-COVID context. A qualitative approach was deemed appropriate given the complexity of the subject, which involves technological, institutional, and behavioral dimensions that are best explored through context-sensitive, descriptive analysis.

The selection of the four case studies was based on multiple criteria: the existence of formal smart tourism strategies or inclusion in broader smart city programs; the presence of functional digital platforms or tools aimed at tourists; public availability of strategic documents and tourism policies; and evidence of post-COVID adaptations incorporating digital innovations. This selection ensured a balanced comparison across various geographic regions and levels of digital maturity, reflecting a mix of highly developed and emerging tourism destinations.

Data collection relied on secondary sources and digital materials, including official municipal websites, smart tourism applications, local and regional tourism strategies, and public reports from international organizations such as the UNWTO, the European Commission, and the OECD. In addition, the research examined mobile applications and online platforms designed for tourists, evaluating their content, usability, interactivity, and user feedback. To ensure data triangulation and enhance reliability, the study also included expert commentaries, academic case studies, and media coverage related to tourism digitalization in each city.

The analysis was conducted using a comparative matrix of indicators. These included: the type and scope of digital tools in use (e.g., mobile apps, VR/AR experiences, integrated booking systems); the level of personalization and real-time interaction; the degree of accessibility and user engagement; the presence of post-COVID features (such as contactless services, health information, or flexible bookings); and the integration of sustainability and inclusion into digital tourism policy frameworks. This matrix facilitated the identification of best practices, recurring challenges, and areas for strategic improvement.

Overall, this methodology offers a comprehensive and context-rich perspective on smart tourism implementation in Europe, enabling meaningful cross-case comparisons and providing insights applicable to other destinations navigating the transition toward digital resilience and competitiveness.

4. Findings

The four selected European destinations—Amsterdam, Dubrovnik, Cluj-Napoca, and Helsinki—have each developed digital infrastructures aimed at enhancing the tourist experience through smart tools and interactive platforms. While their approaches vary depending on technological maturity, tourism profile, and governance models, all four cities have integrated digital components into their tourism systems with notable results.

Amsterdam is widely regarded as a pioneer in digital tourism and sustainability. Its flagship platform, *Iamsterdam*, provides a centralized interface that connects tourists with real-time information on public transport, attractions, events, and cultural activities. The platform features location-aware services, interactive maps, and personalized itinerary suggestions based on user input and preferences. The city also employs data analytics to monitor tourist flows and redirect visitors away from overcrowded areas, enhancing both safety and local satisfaction.

Dubrovnik, facing longstanding issues with overtourism, particularly within its UNESCO-listed old town, has adopted a defensive but innovative smart tourism strategy. The city's *Respect the City* platform includes a cruise ship arrival schedule, real-time capacity tracking, and visitor guidance tools that aim to distribute tourist flows across time and space. Additionally, digital maps, QR-based guides, and mobile navigation systems promote cultural interpretation while reducing physical pressure on fragile heritage sites.

Cluj-Napoca, although not yet internationally recognized as a smart tourism leader, is developing a growing digital ecosystem through collaborations with academia, local IT clusters, and municipal authorities. The city has launched several mobile apps that provide real-time information about local events, transport, accommodation, and heritage trails. Notably, some of these tools integrate augmented reality (AR) to enrich cultural storytelling and tourist engagement. While the platforms are still fragmented, they demonstrate potential and responsiveness to digital demand.

Helsinki distinguishes itself through a fully integrated smart city framework in which tourism plays a prominent role. The *MyHelsinki* portal and mobile app offer a seamless user experience, combining transportation data, personalized recommendations, and sustainable tourism filters. Tourists can select experiences based on themes such as "eco-friendly," "family-friendly," or "local favorite," supported by user reviews and AI-driven suggestions. The city's open data policy enables third-party developers to build apps that further enhance the tourism experience.

Across all four cities, smart tools serve not only as facilitators of information but also as mediators of trust, personalization, and resilience. Their design reflects differing priorities: Amsterdam and Helsinki emphasize integration and sustainability, Dubrovnik prioritizes heritage protection and flow control, while Cluj-Napoca showcases grassroots innovation in a transitional context. Together, they offer a diversified view of smart tourism platforms in action.

Table no. 1. Comparative overview of smart tourism features in selected European cities

City	Mobile Apps	AR/VR	Real-time Info	AI Personalization	Booking Integration
Amsterdam	✓ Advanced	✓ Moderate	✓ Full support	✓ Integrated	✓ Complete
Dubrovnik	✓ Basic	✗ Not available	✓ Active tracking	✗ Not applied	△ Limited
Cluj-Napoca	✓ Functional	✓ Pilot use	△ Partial	△ Experimental	△ Fragmented
Helsinki	✓ Advanced	✓ Advanced	✓ Full support	✓ Integrated	✓ Complete

Source: Author's own elaboration based on official city portals and strategic documents (2024).

Personalization and real-time interactivity are critical dimensions of smart tourism, as they directly influence the tourist's engagement, satisfaction, and perception of service quality. The four selected destinations exhibit varying levels of maturity in implementing these features, reflecting their strategic orientation and digital capacity.

Amsterdam offers a robust level of personalization through its *Iamsterdam* digital ecosystem. The platform uses data-driven algorithms to generate personalized itineraries, recommend attractions based on location, and suggest less crowded routes or times for visiting popular sites. Additionally, real-time interaction is supported through dynamic updates on public transport, events, and local

services. The integration of live data ensures flexibility and responsiveness throughout the tourist journey.

Helsinki also demonstrates an advanced model of personalization via the *MyHelsinki* platform. Tourists can filter experiences based on their interests, sustainability criteria, and travel purpose. The platform employs AI-driven recommendations and integrates user reviews to create a sense of trust and relevance. Real-time functionality is embedded in mobility services, event calendars, and digital maps, offering seamless interaction between the tourist and the urban space.

Dubrovnik, by contrast, focuses more on real-time guidance than on personalization. The *Respect the City* initiative provides live updates on visitor flows and cruise ship arrivals, helping tourists avoid overcrowded areas. However, the lack of AI tools or preference-based content limits the ability to tailor experiences. Interaction is mostly one-directional, oriented toward informing tourists rather than engaging them.

Cluj-Napoca is positioned in an intermediate stage. While some personalization is offered through pilot AR applications and cultural event apps, these tools are not yet centralized or adaptive in real time. The fragmentation of platforms and absence of predictive features suggest that tourists may experience limited interactivity, relying more on static content and manual navigation.

The comparison highlights a clear divide between digitally mature cities (Amsterdam and Helsinki) and transitional destinations (Dubrovnik and Cluj-Napoca). Whereas the former prioritizes user-centered design and real-time adaptability, the latter concentrate on informative functionalities with lower degrees of system responsiveness. Nevertheless, all four cities recognize the importance of digital engagement, albeit at different scales and through different strategic lenses.

As digital platforms become increasingly central to the tourist experience, understanding user preferences and engagement behaviors is essential for the success of smart tourism strategies. In the post-COVID context, tourists have become more selective, informed, and reliant on digital solutions—not only for planning and booking but also for navigating destinations, ensuring safety, and enhancing experiential value.

Across the four analyzed cities, we observe differentiated levels of user engagement with smart tourism platforms, shaped by usability, relevance, language accessibility, and perceived value.

In Amsterdam, the *Iamsterdam* platform is widely used by both international and domestic tourists due to its intuitive interface, multilingual support, and real-time functionality. Tourists show high engagement with features such as itinerary builders, attraction filters, and transport planners. Online feedback indicates a strong preference for centralized apps that minimize the need for third-party services and allow for frictionless navigation.

Helsinki demonstrates similarly high levels of digital interaction, particularly among tech-savvy and environmentally conscious tourists. The *MyHelsinki* platform allows users to engage actively by customizing their experience based on sustainability filters, personal interests, and real-time feedback. User engagement is further supported by the integration of open data, AI recommendations, and interactive urban guides. Helsinki's success lies in its ability to align digital content with user values and identity-driven travel motivations.

In Dubrovnik, user engagement is more pragmatic and issue driven. The city's digital tools are often accessed out of necessity—for example, to avoid congestion in the old town or to consult cruise ship schedules. While tourists do interact with the *Respect the City* platform, engagement tends to be low-frequency and one-way, with limited opportunities for feedback, customization, or community building. This suggests a more passive use of technology, focused on regulation rather than experience enrichment.

Cluj-Napoca presents a mixed picture. Tourists and locals engage with specific tools—such as AR cultural trails or event-specific apps—but report inconsistencies in usability and availability. The lack of an integrated digital environment leads to fragmented engagement patterns, where users rely on multiple apps or informal sources (e.g., social media or Google Maps) rather than a centralized tourism hub. However, there is a growing interest, particularly among young tourists and students, in exploratory and participatory forms of digital tourism.

Common trends across all destinations include a preference for mobile-first solutions, real-time content, and location-based services. Additionally, tourists increasingly value customization, trustworthy information, and visual/interactive content (e.g., maps, video guides, AR). In contrast,

low engagement is often associated with poorly translated platforms, complex interfaces, or lack of perceived added value.

Overall, the findings indicate that user preferences are shifting toward highly personalized, transparent, and interactive digital tourism environments. Cities that anticipate and respond to these expectations—through design, communication, and content strategy—are better positioned to build loyalty, generate positive experiences, and stimulate word-of-mouth promotion.

The COVID-19 pandemic accelerated the digital transformation of tourism by exposing the vulnerabilities of traditional systems and reinforcing the need for flexible, safe, and adaptive digital infrastructure. In response, cities across Europe deployed a variety of digital innovations designed to reduce physical contact, increase transparency, and restore user trust in travel services. The four analyzed cities—Amsterdam, Dubrovnik, Cluj-Napoca, and Helsinki—implemented distinct strategies to address these challenges through technology.

Amsterdam introduced several post-COVID features into its *Iamsterdam* platform. These included real-time crowd monitoring in key tourist areas, alerts about temporary closures or regulation changes, and integrations with public health updates. Digital ticketing systems were upgraded to support contactless access, while flexible cancellation policies were promoted through the platform to reduce uncertainty. Importantly, Amsterdam leveraged behavioral data to encourage visitors to explore alternative, less crowded sites—helping to decentralize tourism pressure in a sensitive moment.

Dubrovnik responded to its overtourism problem by embedding health-oriented data and predictive visitor flow tools in the *Respect the City* platform. Real-time ship traffic dashboards were adapted to highlight periods of reduced density, and digital signage at the city's entry points provided QR-based updates. Although personalization remained minimal, the city prioritized risk reduction and orderly management, which proved essential in maintaining a safe experience for both tourists and residents.

Cluj-Napoca, despite having more limited financial and infrastructural capacity, launched localized apps for event management, digital ticketing, and contactless services in the hospitality sector. The municipality supported small tourism operators in adopting QR menus, e-payment systems, and mobile booking tools. While these innovations were not part of a centralized platform, they represent an important step toward digital maturity and risk mitigation in an emerging tourist destination.

Helsinki distinguished itself through its integration of sustainability and health security. The *MyHelsinki* platform featured dedicated sections on COVID-19 protocols, vaccination sites, and safe transport options. AI tools were used to provide adaptive recommendations based on personal risk profiles or travel group characteristics (e.g., family with children vs. solo traveler). Moreover, the city continued to promote outdoor and low-density experiences using digital trail maps, eco-filters, and self-guided tours.

To summarize the diversity of post-COVID innovations, Table no. 2 provides a comparative overview of the digital safety and flexibility measures implemented by each destination.

Table no. 2. Post-COVID digital innovations and safety measures in selected cities

City	Contactless Services	Crowd Management	Health Info Integration	Flexible Booking	Sustainable Travel Options
Amsterdam	✓ Full implementation	✓ Real-time alerts	✓ Linked to health services	✓ Supported	✓ Promoted via platform
Dubrovnik	✓ Basic (QR)	✓ Cruise schedule app	△ Limited info	✗ Not emphasized	✗ Not prioritized
Cluj-Napoca	✓ Local adoption	△ Partial (events)	△ Institutional only	△ Operator-dependent	△ Pilot level (AR trails)
Helsinki	✓ Integrated	✓ Adaptive planning	✓ Health filters & updates	✓ AI-enhanced	✓ Advanced personalization

Source: Author's elaboration based on public sources and platform analysis (2024).

The post-COVID period has served as both a **stress test and a catalyst** for tourism innovation. Destinations with pre-existing smart infrastructure, such as Amsterdam and Helsinki, were able to adapt rapidly and comprehensively. Meanwhile, Dubrovnik and Cluj-Napoca adopted more focused or reactive solutions, showing that even partial digitalization can offer significant public health benefits. In the future, digital resilience—defined as the ability to adapt digital systems to crises—will likely become a core pillar of sustainable tourism governance.

5. Conclusions

This study explored how selected European destinations—Amsterdam, Dubrovnik, Cluj-Napoca, and Helsinki—have adopted smart tourism tools and adapted their digital platforms to meet evolving user expectations in the post-COVID context. Through a comparative analysis grounded in qualitative evaluation and document-based evidence, the research identified significant differences in the structure, scope, and impact of smart tourism implementation.

The findings indicate that Amsterdam and Helsinki have achieved a high degree of digital maturity, characterized by integrated platforms, advanced AI personalization, and real-time adaptability. These cities exemplify a proactive approach to tourism digitalization, combining technological innovation with sustainability, inclusiveness, and user-centered design. Their platforms reflect not only technical excellence but also strategic coherence, offering seamless experiences across information, mobility, booking, and feedback loops.

Dubrovnik, although more limited in scope, demonstrates how digital tools can effectively manage visitor flows and mitigate the negative effects of overtourism. Its platform prioritizes regulatory functionality and safety, showing that smart tourism can also be a mechanism for destination protection, not just enhancement. However, its low levels of personalization and engagement suggest a need for greater alignment with user-driven innovation.

Cluj-Napoca, as an emerging smart destination, highlights the challenges and opportunities of digital transformation in resource-constrained environments. Despite limited infrastructure, the city has shown flexibility through pilot projects and partnerships, indicating strong potential for future development. The fragmented nature of its digital offer, however, calls for a more unified and strategic approach.

In terms of user behavior, the study confirms that tourists increasingly value mobile-first, real-time, and personalized digital services. Trust, convenience, and relevance are core drivers of engagement. At the same time, poorly integrated platforms, lack of multilingual options, and non-intuitive interfaces act as barriers to adoption—even in technologically advanced destinations.

The COVID-19 pandemic served as an accelerator of digital innovation. Cities that were already investing in smart tourism were able to respond more effectively to emerging safety and communication needs. Contactless services, health-integrated applications, and flexible digital services are now seen not as optional enhancements, but as fundamental components of competitive and resilient tourism systems.

Recommendations:

- Destinations should invest in centralized smart platforms that integrate all aspects of the tourist journey, from planning to real-time support and post-travel feedback.
- AI and big data analytics should be used not only for personalization but also for strategic planning, capacity control, and sustainability monitoring.
- Cities should prioritize user experience design, including multilingual interfaces, visual storytelling, and mobile responsiveness, to increase adoption and satisfaction.
- For emerging destinations, regional cooperation, academic partnerships, and EU funding can be leveraged to accelerate digital transformation.
- Digital strategies should be aligned with broader goals of environmental responsibility, cultural preservation, and social inclusion, ensuring that technology serves both tourists and local communities.

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Section V

Finance and Accounting

Impacts of Macroeconomic Factors on Insolvency: Case of Romanian Companies

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Abstract

Macroeconomic factors leave their mark on the continuity of companies, and studying their impact on corporate insolvency is welcome, especially in the current economic, social and political context. The purpose of this research paper is to survey representatives of 140 companies in Romania in order to present the situation regarding the impact of macroeconomic factors on company insolvency, as well as to analyze the number of insolvencies in Romania and the correlation between GDP and the number of insolvencies in Romania. The first objective is to review the specialized literature on the topic of insolvency, macroeconomic factors and the impact of these factors on corporate insolvency, and the second objective is focused on the analysis of the companies in the research sample. The results consist of providing an overview of the companies in Romania regarding the impact of macroeconomic factors on insolvency. The companies included in the questionnaire sample were analyzed between November 2022 and August 2023.

Key words: macroeconomic factors, insolvency, companies, Romania, GDP

J.E.L. classification: M10, M41

1. Introduction

Any business may at some point face an internal crisis that can jeopardize its operation and image, this situation being characterized by an increased risk of bankruptcy, a weak competitive position, financial instability (Grosu *et al*, 2023, p. 22). Financial difficulty creates many inconveniences within a company, from blockages in making payments to endangering the company's survival. (Apetri *et al*, 2024, p. 3). The notion of insolvency implies a difficult or crisis financial situation of a trader in which liabilities exceed assets, making it impossible for the trader to fulfill the payment obligations assumed on time and in good conditions (Lică, 2012, p. 185).

Just as a company's market value depends largely on its current economic situation and its future prospects, the value of companies depends on the overall economic situation of the country and its future prospects in that country (Peiro, 2016, p. 287). It is widely accepted that a stable macroeconomic framework is necessary, although not sufficient, for sustainable economic growth (Fischer, 1993, p. 487). In this context, the purpose of this research paper is to survey representatives of 140 companies in Romania in order to present the situation regarding the impact of macroeconomic factors on company insolvency, as well as to analyze the number of insolvencies in Romania and the correlation between GDP and the number of insolvencies in Romania.

2. Theoretical background

In the global economy, in the turbulent environment, the effects of the insolvency risk of companies lead to numerous operational and strategic problems, while also being causes of the contagion effect, therefore, it is important to study the insolvency phenomenon, the determining factors that shape it, as well as to look for opportunities to reduce the risk of this problem (Rochon

et al, 2017, p. 21). The competitive economic environment is constantly subject to multiple risks, which requires the application of rigorous principles for their management, and, unfortunately, more and more companies are facing financial difficulties (Voda *et al*, 2021, p. 1039).

Insolvency is the inability of an organization/company to pay its debts, and when such a company is unable to pay on the due date, it is considered critical insolvency (Onakoya *et al*, 2017, p. 707). The contemporary business conditions in which today's companies operate require them to be able to fulfill their obligations in order not to be eliminated by the competition (Kušter *et al*, 2023, p. 1). Also, the possible occurrence of an insolvency situation represents a serious threat to various economic agents who hold an interest in insolvent organizations (Pindado *et al*, 2004, p. 51).

Insolvency and implicitly bankruptcy are the consequence of a high degree of indebtedness and a relatively low degree of solvency and depend on a series of factors specific to the sector of activity, the entity or the economic environment, which can bring the entity into a state of difficulty from an economic, financial, legal and socio-political point of view, which forces it to enter the judicial reorganization procedure (Holt, 2009, p. 325). Bankruptcy risk can be defined as the inability of companies to meet a due payment, namely its inability to repay the borrowed amounts on time under the conditions established by mutual agreement with third parties, based on an economic or credit contract (Popescu *et al*, 2009, pp. 7-8).

Previous studies on the impact of macroeconomic factors on corporate insolvency have chosen for research the following most important macroeconomic factors that influence corporate insolvency: GDP growth rate, interest rate, inflation, unemployment rate, company start-up rate, consumer price index, foreign exchange rate (Yung *et al*, 2025, p. 1; Sang *et al*, 2014, p. 2; Mačerinskienė *et al*, 2013, p. 39). Inflation occurs anytime, anywhere and cannot be controlled (Ridwan, 2022, p. 1). In general, the cause of inflation in developed countries is generally identified as the increase in the money supply, while in developing countries, on the other hand, inflation is not a purely monetary phenomenon (Totonchi, 2011, p. 459). GDP is the important factor for knowing the stability of a country's financial situation (Sa'adah *et al*, 2020, p. 32).

Unfavorable macroeconomic conditions, combined with the central bank's decision to maintain an appreciated exchange rate, negatively influence industrial production, which consequently also leads to increased corporate insolvency (Žiković, 2016, p. 526).

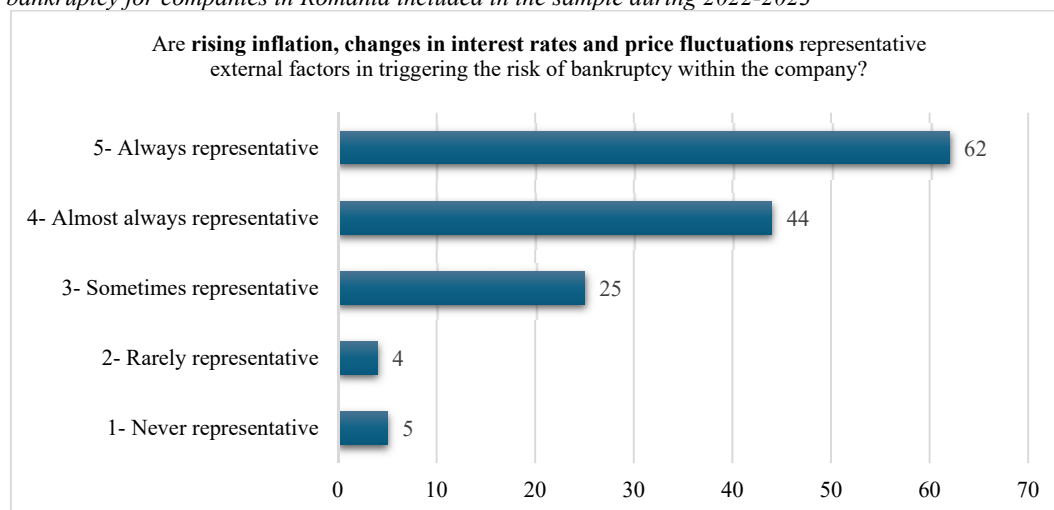
3. Research methodology

In order to conduct the research, data was collected through a questionnaire, but also through INSSE and coface reports on the insse.ro and coface.ro websites. The influence of the following macroeconomic factors on company insolvency was analyzed: inflation, interest rates, prices and GDP. The questionnaire was applied during 2022-2023 to 140 companies in Romania, and the data from the INSSE and coface reports were analyzed during 2012-2024. The fields in which the companies included in the questionnaire operated are diverse, with all companies included in the database, regardless of whether they operate in the field of production, services or trade. The people who checked the questionnaire answers occupy one of the following positions within the company: manager/administrator, chief accountant/accountant and associate/shareholder/investor.

4. Findings

This section presents the results obtained from distributing the questionnaire to representatives of the companies included in the analysis, as well as analyzing and interpreting data on the number of insolvencies in Romania and the evolution of GDP in correlation with the number of insolvencies.

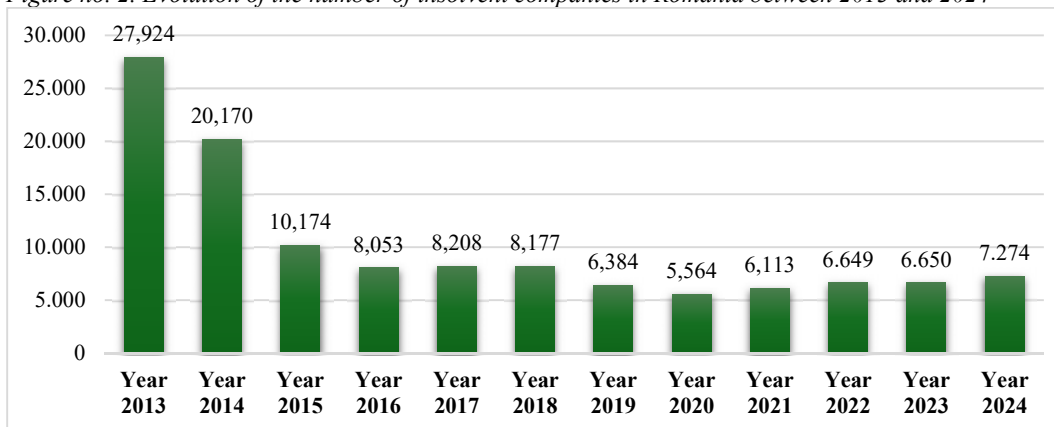
Figure no. 1. The degree of representativeness of external macroeconomic factors in triggering the risk of bankruptcy for companies in Romania included in the sample during 2022-2023



Source: authors' own processing based on the questionnaire

According to the results of the research, rising inflation, changes in interest and price fluctuations are representative external macroeconomic factors in triggering the risk of bankruptcy for the companies analyzed (see Figure no. 1), with 62 responses for the answer "5- always representative" and 44 responses for the answer "4- almost always representative". It can be observed that these macroeconomic factors, namely rising inflation, changes in interest and price fluctuations, were not checked as being rarely representative and never representative in triggering the risk of bankruptcy, only by 4 and 5 respondents, respectively, which demonstrates the significant influence of these factors in the occurrence of insolvency within the company.

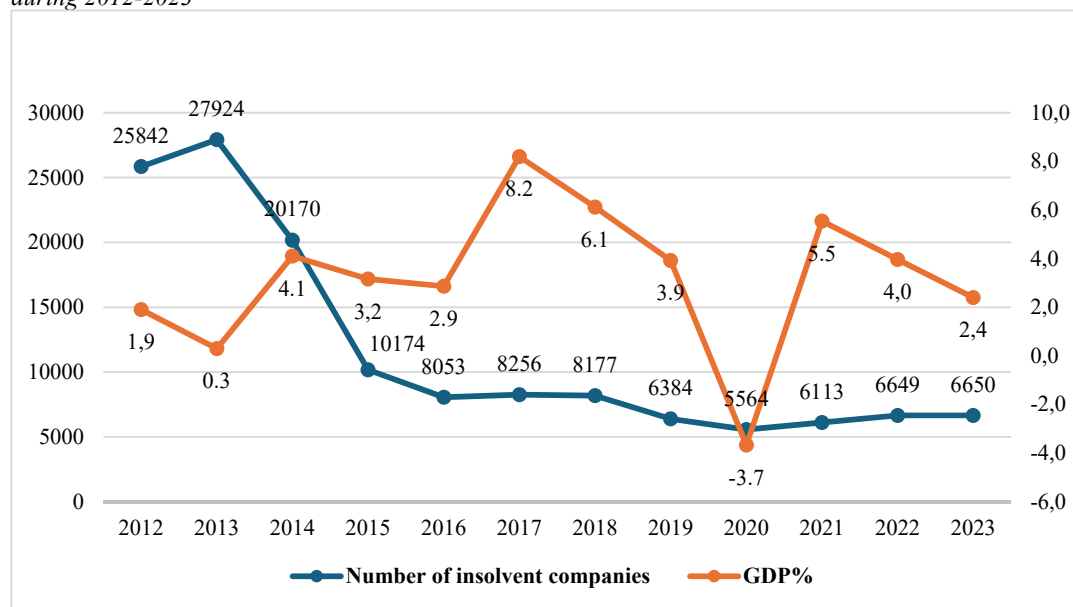
Figure no. 2. Evolution of the number of insolvent companies in Romania between 2013 and 2024



Source: authors' own processing based on data from the Coface

It can be seen in Figure no. 2 that most company insolvencies were registered in 2013 due to the post-crisis phenomenon related to the global crisis of 2010. After 2014, there is a downward trend in the number of bankruptcies, reaching 7,274 insolvent companies in 2024. The unexpected positive results in 2020 are explained by the existence of support measures offered to companies by the government in the context of the health crisis. However, the repercussions of the health crisis began to be felt after 2020, when already in 2021 the number of insolvencies began to increase significantly until 2024 inclusive.

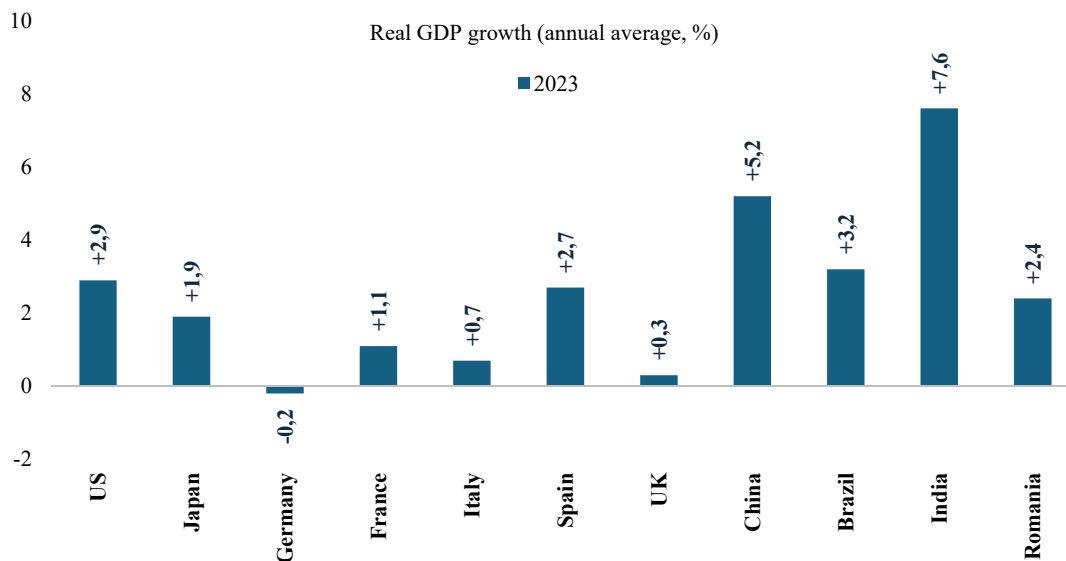
Figure no. 3. Evolution of the number of insolvent companies and the evolution of GDP in Romania during 2012-2023



Source: authors' own processing based on data from the INSSE and Coface

In Figure no. 3 it is observed that GDP resumed its upward trend after 2013, immediately mitigating the number of insolvencies that decreased until 2020. It is easily observed in Figure no. 3 that the increased GDP values have a positive influence on the number of insolvencies in Romania, as they decreased significantly during the period 2013-2020. In 2020, the health crisis influences the sudden decrease in GDP, which has a negative value. The decrease in GDP in the period 2021-2023 also influences the increase in the number of insolvencies amid the post-Covid19 effects and the geopolitical crisis.

Figure no. 4. Annual GDP recorded in 2023 in the main states and countries of the world - comparison with Romania



Source: authors' own processing based on data from the Coface and INSSE

Figure no. 4 shows that Romania is in a good position in terms of GDP growth in 2023 compared to 2022 (by +2.4) compared to the other important states and countries included in the analysis. However, in 2023 the upward trend in GDP was not felt in the number of registered insolvencies as they experienced an increase in the period 2023-2024 (see Figure no. 2).

5. Conclusions

Many studies focus on the study of internal factors in triggering corporate insolvency. Therefore, this study aims to complement the specialized literature, but especially to help managers and all those interested in the topic of corporate insolvency, to be aware of the influence of macroeconomic factors on the continuity of companies. The following macroeconomic factors with influence on corporate insolvency were chosen for analysis in this research: inflation, interest rates, price fluctuations and GDP.

It has been shown that of the 140 Romanian companies analyzed, the vast majority consider inflation, interest rate changes and price fluctuations to be external factors triggering the risk of bankruptcy within the company. As for company insolvencies, they were recorded most often in 2013 due to the post-crisis phenomenon related to the global crisis of 2010. After 2014, there is a downward trend in the number of insolvencies, reaching 7,274 insolvent companies in 2024. The unexpected positive results in 2020 are explained by the existence of support measures offered to companies by the government in the context of the health crisis. However, the repercussions of the health crisis began to be felt after 2020, when already in 2021 the number of insolvencies began to increase significantly until 2024 inclusive. Also, the increased GDP values have a positive influence on the number of insolvencies in Romania, as they decreased significantly in the period 2013-2020. Romania is in a good position in terms of GDP growth in 2023 compared to 2022 (+2.4) compared to the other major states and countries included in the analysis. However, in 2023 the upward trend of GDP was not felt in the number of registered insolvencies as they experienced an increase in the period 2023-2024.

There may be other external factors influencing corporate insolvency, including: economic recession, national or international crises, unfair competition, entry/exit of the company into/from different market niches, economic changes or changes in demographics, technology or regulations. Therefore, these listed external factors may constitute benchmarks for future studies to complement the present study.

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Mapping the Intersection of Cost, Employee Benefits, and ESG: A Bibliometric Analysis of Corporate Sustainability and Performance

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Abstract

The aim of this study is to investigate research concerns regarding cost, employee benefits, and ESG aspects. A bibliometric analysis was conducted for this purpose. The Web of Science represents the database for data retrieval, while the VOSviewer software was employed for data processing. A review of extant literature reveals a number of key themes, including employee satisfaction and ESG activity; social initiative, social performance and financial performance; corporate governance and employee relations; board risk oversight; ESG activity and performance; and intra-firm pay gap. The implications of this study are both managerial and social.

Key words: employee benefits, performance, cost, ESG

J.E.L classification: F30, G38

1. Introduction

Employee Stock Ownership Plans (ESOPs) are essential for enhancing employee engagement and improving corporate governance, significantly impacting sustainability within the Environmental, Social, and Governance (ESG) framework. Although establishing ESOPs incurs costs, their benefits—such as improved performance, innovation, and alignment with environmental goals—underscore their importance for long-term success (Kruse *et al*, 2004, p.3). By integrating ESOPs into their ESG strategies, companies not only boost performance but also foster social responsibility, creating sustainable business models that address contemporary challenges.

Despite the high implementation costs associated with ESOPs, they provide numerous advantages. The effectiveness of this employee benefit largely depends on the industry (Kiura, 2019, p.4). In sectors where human capital is paramount, ESOPs can lead to exceptional results and enhance overall organizational performance. Employees are motivated to excel as they contribute to a company they now partly own. This drive to retain talent and improve performance encourages companies to adopt this benefit, despite the higher costs. Moreover, this ecosystem aligns with the ESG framework, as integrating ESOPs into corporate governance fosters a culture that adheres to ESG standards (Zeng, 2024, p.5).

The research question guiding this study is: "How do ESOPs influence the adoption and performance of ESG practices in companies?" This inquiry addresses a gap in the literature regarding the impact of employee benefits like ESOPs on ESG standards and integration costs. ESOPs can enhance performance while simultaneously improving corporate life quality.

The objective of this bibliometric research is to identify trends in the literature connecting ESOPs, ESG, and corporate performance. The goal is to analyze the relationships among these terms and their mutual influence.

Sustainable development is defined as a model that integrates economic, social, and environmental aspects to ensure a higher quality of life for all. Key focuses include efficient resource use, reduced environmental impact, and social justice promotion. The strategic importance of human capital has led management to prioritize employee satisfaction and commitment, fostering a new company culture and enhanced performance. Additionally, investing in employee development cultivates organizational loyalty and reduces turnover, which, despite incurring financial costs, ultimately leads to long-term profitability.

The intersection of employee benefits, cost structures, and ESG practices has become a significant topic in corporate research. As organizations seek to balance financial performance with sustainability, ESOPs have emerged as a crucial mechanism for aligning employee interests with corporate goals (Kruse et al., 2004). ESOPs serve not only as compensation but also as tools for enhancing employee engagement, innovation, and corporate governance (Liu et al, 2024; Blasi et al, 2016). Although implementing these plans involves substantial upfront costs, research indicates that long-term benefits may include increased productivity, stronger organizational commitment, and improved ESG outcomes (Kurland, 2018; Kong et al., 2023).

The strategic significance of human capital in the ESG context is supported by empirical findings showing that employee involvement in ownership structures can promote sustainable corporate behavior, including environmental stewardship and ethical governance (Chava, 2014; Gilmore, 2022). ESOPs encourage shared accountability and transparency, fostering a culture aligned with ESG standards. However, findings are not universally positive; some studies indicate that leveraged ESOPs may raise a firm's cost of capital or strain liquidity if not carefully integrated into the financial model (Jung et al, 2021; Ivanov et al, 2011).

Despite the growing literature on these dimensions, few studies provide a comprehensive view of how employee benefits, financial performance, and ESG indicators intersect. There is a lack of integrated bibliometric analyses mapping the intellectual landscape and thematic connections across these domains, leaving a research gap in understanding the systematic relationships between ESOP implementation, associated costs, and their influence on ESG adoption and corporate performance.

2. Theoretical background

ESOPs are a strategic way to enhance employee engagement, improve corporate governance, and support sustainability within the ESG framework (Liu et al, 2024, p.2). While they come with some costs, the benefits of better performance, innovation, and alignment with environmental goals highlight their importance (Blasi et al, 2016). As companies increasingly recognize the need for sustainability, ESOPs could be a vital tool for achieving long-term success while addressing urgent environmental issues.

Key findings from research about the advantages, costs, and overall effects of ESOPs focus on their role in promoting sustainability and corporate responsibility. Research shows that companies with ESOPs often see higher sales and job growth (Kurland, 2018, p.3). Additionally, ESOPs can improve corporate governance since employee directors can oversee executive actions, helping to reduce conflicts between shareholders and management (Kong et al., 2023, p.4). In terms of sustainability, ESOPs encourage long-term thinking that aligns with environmental goals (Chava, 2014, p.3). They motivate employees to manage resources wisely and reduce pollution, which can lead to innovation in these areas. The shared ownership model of ESOPs promotes transparency and accountability, which are crucial for good governance and sustainable practices (Gilmore, 2022, p.4).

Despite their many benefits, ESOPs can also have drawbacks. Setting up leveraged ESOPs might raise a company's cost of capital, especially if it takes on too much debt. On the other hand, non-leveraged ESOPs could affect cash flow if they are funded with cash, potentially increasing the company's risk (Jung et al., 2021, p.4). The evidence on how ESOPs impact overall capital costs is still unclear, indicating a need for more research on their financial effects (Ivanov et al., 2011, p.2). Integrating ESOPs into the ESG framework shows how they can improve corporate performance while promoting sustainability. Studies suggest that companies with more employee ownership often perform better in ESG areas, as employee interests align with long-term corporate goals. Institutional investors also play a key role, as their focus on sustainable practices often matches the objectives of employee-owned companies (Liu et al, 2024, p.2).

Moreover, ESOPs can boost a company's ability to innovate, as employees are more likely to engage in projects that meet both economic and environmental goals (Kong *et al.*, 2023, p.4). Research indicates that ESOPs not only enhance stock performance but also contribute to overall corporate stability and wealth creation, making them relevant in discussions about environmental economics.

In addition to direct financial outcomes, employee benefits are increasingly viewed through the lens of non-financial performance, especially within ESG (Environmental, Social, and Governance) frameworks (Choi *et al.*, 2024). As noted by (Liu *et al.*, 2024) and (Kong *et al.*, 2023), ESOPs and other participative benefit structures support several ESG objectives, such as inclusive governance, equitable wealth distribution, and employee empowerment. These outcomes can translate into improved investor confidence, enhanced reputational capital, and access to ESG-linked financing, thereby indirectly influencing financial performance.

However, the literature also notes several cost-related concerns and contingencies (Babenko *et al.*, 2016). Leveraged ESOPs, for example, may increase a firm's financial risk if not carefully managed. (Jung *et al.*, 2021) and (Ivanov *et al.*, 2021) highlight the potential trade-offs between short-term financial strain and long-term ownership benefits, particularly in capital-intensive or low-margin industries. These studies stress the importance of aligning benefit structures with the firm's financial strategy and operating model.

Despite these findings, bibliometric analyses at the intersection of employee benefits, cost structures, and ESG remain scarce. While the ESG literature is expanding rapidly, relatively few studies synthesize how internal workforce policies—especially financial and participatory benefits—affect a firm's holistic performance. This lack of integration highlights a gap in the academic literature and justifies the need for a structured bibliometric mapping, as undertaken in this study. By analyzing how research has addressed the convergence of employee benefit policies, financial outcomes, and ESG considerations, this review provides the foundation for a broader understanding of sustainable human capital practices and their strategic value in modern corporations.

3. Research methodology

Through bibliometric methods this research explores the relationships between organizational costs, employee benefits and Environmental, Social and Governance (ESG) criteria (D'Amato *et al.*, 2024). Academic publications receive quantitative analysis through bibliometric methods which identifies structures and thematic clusters as well as research trends. The study implements this method to establish a systematic understanding of how financial elements and ESG factors appear in academic research. The Web of Science (WOS) served as the database for data retrieval, functioning as an authoritative academic publication collection. A search was performed on May 19, 2025, using the keywords "cost," "employee benefits," and "ESG". The chosen keywords aimed to narrow down literature that examines economic and social-environmental connections between financial and ESG elements. A set of quality and relevance criteria was used to filter the search results which produced the final set of data.

The research focused exclusively on peer-reviewed journal articles and conference proceedings that contained direct discussions about the core variables' relationship. After applying these filters, a total of 15 academic documents were retained for analysis.

VOSviewer software processed and analyzed the collected data. The established bibliometric tool VOSviewer performed term co-occurrence and keyword co-occurrence mapping, co-authorship network visualization as well as bibliographic coupling.

The term co-occurrence analysis set a threshold of two occurrences per term to identify the most important and prevalent terms in the selected literature. The analysis examined 49 of 578 unique terms which met the established threshold. This step was essential for identifying central themes and the conceptual structure of the research field. Additionally, the keywords co-occurrence analysis was performed. Of 157 keywords, 76 were selected, specific to the analyzed topic.

The co-authorship network analysis was conducted to generate meaningful visualizations of researcher contributions to the topic. This approach helped to discover the collaborative work patterns in the field. Bibliographic coupling analysis evaluated document connections through their shared reference points. The analysis focused on influential academic publications that received at

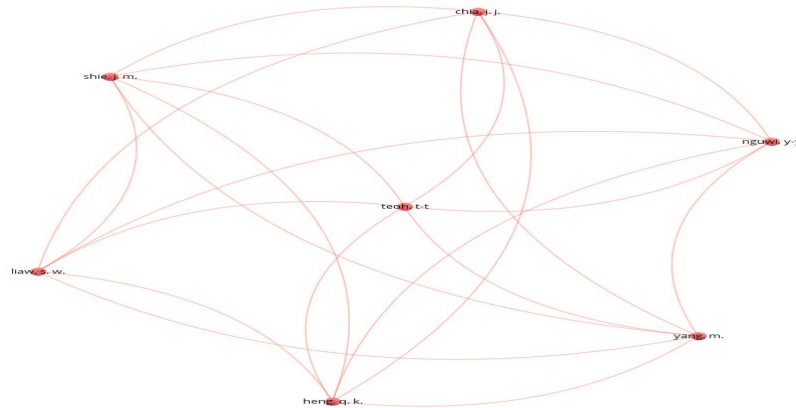
least five citations per document. Each document in the dataset received an analysis of total link strength to determine which studies formed the closest relationships and which produced the most influential research. The bibliometric approach used in this study created an academic map of cost management, employee benefits and ESG implementation research which demonstrates their connections in academic literature.

4. Findings

4.1. Co-authorship

Of the 49 authors, the largest set of connected authors consists of seven: Teoh, Heng, Chia, Shie, Liaw, Yang, and Nguwi (Figure 1). These authors developed machine learning models to examine the relationship between ESG scores and a company's Return on Equity. In order to quantify the financial benefit that CSR can bring to a firm and to anticipate the impact, neural network-based models have been shown to have a high degree of accuracy, with the highest accuracy of 81.08% being achieved based on the Multilayer Perceptron Neural Networks model.

Figure no. 1. Co-authorship analysis through cartography analysis



Source: Author's own elaboration

4.2. Terms co-occurrence

The analysis of terms co-occurrence ensures the identification of research topics (Figure 2) in the studied field.

Figure no. 2. Terms co-occurrence analysis through cartography analysis



Source: Author's own elaboration

Research topic 1: Employee satisfaction and ESG activity. In the context of a flexible labor market, the correlation between employee satisfaction and stock returns is notably strengthened. In this regard, greater recruitment, retention and motivation benefits are provided to employees, thereby ensuring their satisfaction. Additionally, labor market flexibility increases the link between employee satisfaction and current valuation rates, as well as future profitability. In the event of elevated labor market flexibility, capital investment in companies with high levels of employee satisfaction is predicted to generate higher returns (Edmans *et al*, 2024).

Research topic 2: Social initiative, social performance and financial performance . The adoption of social initiatives by companies has been demonstrated to result in enhanced financial performance. It has been demonstrated that profitable, mature, capital-intensive firms with high sales growth rates tend to invest more in social initiatives. Firms with high agency costs have been found to invest in social initiatives for the purpose of workforce efficiency, the maintenance of human rights, and product responsibility. It is evident that social investments function as a value-creating mechanism for firms, which consequently results in enhanced financial performance with regard to operating and stock market performance. Firms with high dividend intensity allocate funds to social initiatives for workforce welfare and human rights. Investment in employee well-being and community initiatives results in a number of intangible benefits, including improved stock market valuation (Bhaskaran *et al*, 2024).

Research topic 3: Corporate governance and employee relation. Corporate governance and employee relations are two interconnected aspects that exert a direct influence on a company's performance and sustainability. The concept of employee relations pertains to the interaction between companies and their employees, facilitated by a company's management and control system. It encompasses aspects such as salary negotiations, working conditions, communication, and conflict resolution. The implementation of good governance can result in the cultivation of healthier employee relations through a number of mechanisms. Firstly, fair treatment and diversity can be promoted through the upholding of equal opportunities and non-discriminatory policies. Secondly, ethical leadership can be encouraged through leaders setting an attitude that affects morale and ethical behaviour. Thirdly, the implementation of clear and enforced workplace policies can ensure the conduction of safety and rights. Finally, the establishment of accountability mechanisms can facilitate the resolution of grievances and ensure managerial accountability.

ESOPs serve to unify members in a shared interest, thereby empowering them to exert pressure on management to reduce carbon emissions. This, in turn, benefits their physical well-being and serves to increase their residual interest in long-term corporate wealth. Moreover, companies that allocate funds to the sphere of environmental protection are likely to forgo short-term profit opportunities due to the presence of substantial initial costs. However, this strategic decision can ultimately contribute to an enhancement in long-term firm value. The positive effects observed can be attributed to ESOP schemes that feature higher employee subscription rates, a greater number of non-executive employees, and longer validity periods of ownership. The incentive effect of the latter is sufficiently powerful to offset the free-rider problem (Kong *et al*, 2024).

Recognizing the impact of corporate behavior, which may seek to achieve profit at the cost of harming the environment or damaging stakeholder relationships, and adopting an ESG mindset drives the creation of environmental, social and governance performance. The prevailing sentiment among employees, which posits that corporations are legally bound to prioritise shareholder value maximisation, alongside the concomitant corporate actions that are a by-product of this belief, act as an impediment to the establishment of ESG performance. Stakeholders, the media, NGOs, regulators and ESG rating agencies are exerting pressure on corporations to reduce the environmental and social harm they cause. Considerations such as climate change, waste, pollution, diversity and inequality are driving corporations to adopt a new vision. Overcoming the barriers to ESG implementation that are caused by corporate employees' belief in maximising shareholder value is dependent on an ESG mindset and governance issues such as reviewing values, implementing internal ESG practices and aligning employee incentive plans (Sheehan *et al*, 2023).

Depending on their nature, employee relations are based on both financial incentives and non-financial incentives, with a positive effect on innovation. Thus, profit-sharing plans, stock option plans and stock ownership create a direct link between a firm's performance and employee compensation and, therefore, could be expected to encourage successful innovation. Likewise, good

pension plans, good relations with unions and a variety of specific benefits (such as flexitime) could enable innovation performance through their effect on employee morale or institutional loyalty (Brander *et al*, 2017).

Research topic 4: Board risk oversight. Greater awareness of environmental and social risks leads to increased board involvement in their management, with the possibility of establishing environmental and social compensations, setting environmental targets, adopting policies that address environmental and social risks and opportunities, and reporting on these issues. The oversight of risk by the board of directors can be considered a constrained optimisation problem, in which risk exposures are prioritised and assigned varying degrees of board oversight. Consequently, an augmented role for the board in risk oversight may be associated with favourable environmental outcomes, but unfavourable social outcomes, such as diminished employee benefits and an elevated probability of social risk incidents (Amiraslani *et al*, 2025).

Research topic 5: ESG activity and performance and intra firm pay gap. High ESG performance is significantly associated with widening the intra-firm pay gap. The gap comes mainly from the increase in management compensation, while the rank-and-file employees' salaries remain unchanged. The effect of ESG performance on intra-firm pay differentials is intensified when the majority shareholder exerts more influence and rank-and-file employees' have less bargaining power (Zhang *et al*, 2025).

4.3. Keywords co-occurrence

The nodes with the highest total link strength (Figure 3) are: performance (48), corporate governance (40), sustainability (40), cost (28), ESG performance (21), job satisfaction (16), organizational commitment (16), ESOP (15). The significant co-occurrence links are those between: performance, employee treatment, reputational cost, labor incidence (1), ESG activity, job satisfaction, organizational commitment, self-determination (2), corporate governance, ESG, socially responsible investment, union (3), ESG performance, managerial ability, bargaining power, pay gap (4), board risk oversight, sustainability (5), financial performance, human rights, social initiatives, workforce (6), cost, employee incentives, ESOP, financial constraints (7) and employee relations, agency cost, innovation (8).

The most prominent link between corporate governance and performance nodes is that strong governance improves strategic decisions and investor confidence, which in turn enhances firm performance. It is an irrefutable fact that elevated operational expenditures invariably have a deleterious effect on profitability. However, investments in human capital may temporarily increase costs while boosting long-term performance. The correlation between employee satisfaction and key performance indicators, including productivity, innovation, and organizational commitment is a subject of research. Reduced turnover and enhanced efficiency resulting from such a workforce are further benefits of employee satisfaction. Additionally, employees who demonstrate a strong sense of commitment are known to align with the organizational goals, exhibit a greater degree of dedication to their work, and often remain in their positions for extended periods of time. This has a positive impact on team stability and productivity, thereby enhancing overall performance. The notion of employee ownership has been demonstrated to engender a heightened sense of ownership and accountability. This can improve motivation, reduce agency problems, and align interests with those of the company, enhancing overall performance. Conversely, companies with poor employee treatment may also demonstrate poor ethical standards. A company that prioritizes short-term cost savings over employees hurts its long-term growth capacity.

5. Conclusion

Focusing on ESG activities and performance is a present constraint for all companies, as a condition for long-term development. It is imperative to acknowledge the pivotal role that employees play in the context of a company. Their active participation and innovative thinking have been proven to enhance productivity and stimulate new ideas, thereby directly contributing to the organization's success and growth. The provision of various benefits to employees is cost by a company, with a concomitant reduction in short-term profitability, for the purpose of long-term development.

The present study investigates issues such as cost, employee benefits and environmental, social and governance (ESG) aspects. Analysis of previous research identifies the main topics in the literature: employee satisfaction and ESG activity; social initiative, social performance and financial performance; corporate governance and employee relation; board risk oversight; ESG activity and performance and intra firm pay gap.

The implications of this study are twofold, both managerial and social. It is recommended that policies be implemented which provide benefits to employees, both financial and non-financial, with a view to stimulating creativity and strengthening their commitment, ensuring their retention.

Future research directions aim to deepen the analysis by categories of employee benefits, with an assessment of their costs and implications for ESG performance.

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From Disclosure to Impact: ESG Reporting as a Driver of Financial Outcomes Across Romanian Sectors

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Abstract

As ESG (Environmental, Social, and Governance) frameworks gain traction globally, their financial implications in emerging markets remain underexplored. This study investigates the extent to which ESG reporting affects firm-level financial performance in Romania, a post-transition EU economy. Drawing on a balanced panel of 300 companies across key sectors between 2018 and 2022, we classify firms by ESG disclosure consistency and examine links to EBITDA, profit margins, and earnings volatility. The results reveal that consistent ESG reporters significantly outperform non-reporters, particularly in sectors such as Information and Communication or Energy, where ESG materiality is high. Conversely, traditional industries like manufacturing and trade show weaker financial outcomes, underlining the role of sector-specific dynamics. These findings underscore ESG reporting not merely as a compliance tool, but as a strategic asset whose value is contingent on long-term engagement and industry alignment. The paper offers actionable insights for firms, investors, and policymakers seeking to advance sustainability while preserving financial resilience.

Key words: ESG reporting, financial performance, Romanian firms, sectoral analysis, sustainability
J.E.L. classification: G30, M14, Q56

1. Introduction

In the past two decades, the integration of Environmental, Social, and Governance (ESG) frameworks into corporate strategies has evolved from a voluntary initiative into an increasingly institutionalized requirement, particularly in developed economies. ESG reporting is now widely recognized not only as a tool for enhancing corporate transparency and ethical positioning, but also as a mechanism for long-term financial risk mitigation and value creation (Eccles, Ioannou, & Serafeim, 2014; Friede, Busch, & Bassen, 2015). Institutional investors, regulators, and consumers alike demand that firms demonstrate measurable commitment to sustainability and responsible governance, often linking such performance to capital access and reputational capital.

However, the empirical relationship between ESG practices and financial outcomes remains context-dependent. While evidence from mature markets suggests a positive correlation between ESG engagement and indicators such as return on assets, profitability, or market valuation (Clark, Feiner, & Viehs, 2015), findings from emerging economies are more heterogeneous. These regions are frequently characterized by institutional voids, regulatory underdevelopment, and lower ESG enforcement mechanisms, which may alter the cost-benefit calculus of sustainability investments (Khanna & Palepu, 2010; Amel-Zadeh & Serafeim, 2018).

Romania, as a post-transition economy integrated into the European Union since 2007, offers a relevant empirical setting to investigate these dynamics. While ESG principles are formally endorsed by EU-wide directives such as the Corporate Sustainability Reporting Directive (CSRD), their operational implementation remains uneven across Romanian sectors and firms. The nascent ESG landscape, coupled with the country's mixed economic structure—ranging from legacy extractive industries to rapidly growing IT and services sectors—presents an opportunity to study sectoral divergences in ESG efficacy.

This study aims to assess whether consistent ESG reporting is associated with superior financial performance among Romanian firms between 2018 and 2022. By leveraging a panel dataset of 300 companies across multiple industries, the paper evaluates the relationship between ESG disclosure levels and key financial indicators such as EBITDA, turnover, and profit margin. A special focus is placed on the volatility of financial performance, acknowledging the risk-mitigating potential of ESG engagement. Furthermore, the sectoral analysis identifies where ESG adoption yields the highest financial returns, thereby providing insights into industry-specific strategic ESG planning.

By addressing these research gaps, the paper contributes to the literature on ESG-financial performance linkages in emerging markets, and offers practical implications for corporate managers, policymakers, and investors seeking to align sustainability objectives with financial resilience.

2. Literature review

ESG and financial performance: global evidence. The theoretical and empirical foundations linking ESG performance to corporate financial outcomes have been widely discussed in recent years. From a resource-based view, firms that internalize sustainability practices can develop unique capabilities and reputational advantages that lead to superior financial performance (Hart, 1995; Barney, 1991). Empirical meta-analyses have largely validated this hypothesis: Friede, Busch, and Bassen (2015) reviewed over 2,000 studies and found that approximately 90% reported a non-negative, and the majority a positive, correlation between ESG and corporate financial performance.

Further, Eccles et al. (2014) observed that companies classified as "high sustainability" outperformed their counterparts over the long term in both stock market and accounting performance metrics. Similarly, Khan, Serafeim, and Yoon (2016) argued that ESG investments generate value particularly when they are material to the firm's core operations, reinforcing the importance of industry context in ESG efficacy.

Regional gaps: emerging vs. developed economies. Despite robust findings in developed markets, the ESG-financial performance nexus remains underexplored in emerging and transitional economies. These settings are often marked by weaker institutional infrastructures, regulatory uncertainty, and underdeveloped stakeholder accountability systems (Khanna & Palepu, 2010). As a result, ESG reporting in such contexts tends to be reactive—driven by external legitimacy pressures rather than internal strategic priorities (Jamali, Safieddine, & Rabbath, 2008).

For instance, empirical studies in Central and Eastern Europe (CEE) suggest a mixed relationship between ESG implementation and financial metrics. Mura and Longo (2022) find that in post-socialist countries, ESG disclosures are often symbolic, serving more as signaling tools for foreign investors than for internal transformation. In Romania specifically, public ESG reporting is still at an incipient stage, with most disclosures unstandardized and highly heterogeneous across firms and sectors (E&Y, 2022; CSRMedia, 2021).

Sectoral variation in ESG effectiveness. The literature also emphasizes that ESG's financial benefits are not uniformly distributed across sectors. Industries with high stakeholder visibility or significant environmental/social externalities—such as finance, information technology, and energy—tend to reap greater value from ESG alignment (Clark et al., 2015; Ioannou & Serafeim, 2012). Conversely, more traditional or capital-intensive sectors like manufacturing, extractives, or agriculture often face higher adaptation costs and slower return horizons for sustainability investments.

Moreover, sector-specific ESG materiality plays a crucial role. The SASB (Sustainability Accounting Standards Board) materiality framework underscores the need for firms to tailor ESG strategies to sector-specific risks and opportunities, reinforcing the hypothesis that a one-size-fits-all approach is ineffective and potentially misleading (SASB, 2018).

Research gap and contribution. While existing scholarship establishes a broad connection between ESG and financial outcomes, it often lacks granularity in two key areas: (1) how this relationship manifests in underregulated, transitional economies, and (2) how industry-specific characteristics moderate ESG's financial impact. This study addresses these gaps by investigating Romanian firms over a five-year period, introducing a three-tier classification of ESG engagement and mapping it against financial performance indicators disaggregated by sector.

By combining longitudinal data analysis with a sectoral lens, this research aims to offer novel insights into how ESG reporting may function not just as a moral imperative or compliance activity, but as a performance-enhancing strategic tool—conditional on consistency and context.

3. Research methodology

The analysis draws on a balanced panel of 300 Romanian firms across key economic sectors—manufacturing, agriculture, IT, energy, and finance—classified according to NACE Rev. 2 and BvD sector codes. The sample includes both domestic enterprises and subsidiaries of multinational corporations, varying in size and ownership structure.

Financial indicators (EBITDA, turnover, profit margin) were sourced from the Orbis database, while ESG disclosure data were manually compiled from official company websites and sustainability reports. All monetary values are expressed in thousands of USD for standardization.

Firms were categorized into three ESG engagement tiers: non-reporters (no disclosures), single reporters (one disclosure), and consistent reporters (two or more disclosures). The empirical strategy combines descriptive statistics, correlation analysis, and sectoral comparisons. EBITDA volatility is employed as a proxy for financial resilience, and sectoral patterns are interpreted through the lens of ESG materiality, following Sustainability Accounting Standards Board framework.

4. Findings

The empirical analysis reveals that ESG engagement is positively associated with financial performance, particularly when sustainability reporting is consistent over time. Firms classified as consistent reporters exhibit significantly higher average EBITDA levels and reduced earnings volatility compared to non-reporting counterparts.

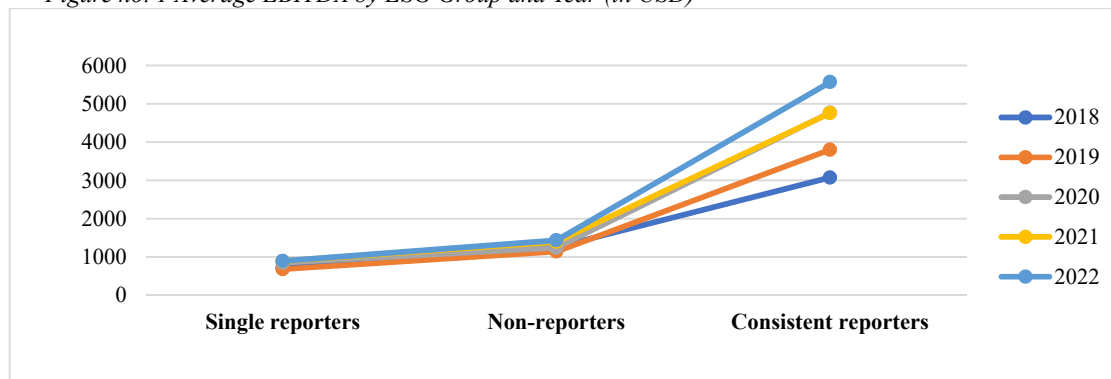
ESG engagement and EBITDA performance. To assess the financial impact of ESG engagement, average EBITDA was computed for each group of firms—non-reporters, single reporters, and consistent reporters—over the 2018–2022 period (Table 1). The results reveal a strong, persistent performance advantage for firms that consistently disclose ESG information.

Table no. 1 Average EBITDA by ESG Group and year (th USD)

ESG Group	2018	2019	2020	2021	2022
Non-reporters	1,255	1,141	1,242	1,396	1,436
Single reporters	714	682	849	891	896
Consistent reporters	3,073	3,802	4,769	4,758	5,569

Source: Orbis

Figure no. 1 Average EBITDA by ESG Group and Year (th USD)



Source: Own elaboration in Excel, based on data from Orbis

In 2018, consistent reporters already outperformed the other groups, with an average EBITDA of over \$3 million, compared to just \$1.25 million for non-reporters and \$714k for single reporters. This gap widened significantly over time, reaching \$5.57 million in 2022, more than 3.8 times higher than the average for single reporters and nearly 4 times that of non-reporters.

This trend suggests that ESG maturity may enhance operational efficiency, access to capital, or stakeholder confidence, particularly in uncertain or volatile economic periods such as 2020–2021. Notably, firms with only a single ESG disclosure show modest gains but remain far below the consistent reporters, highlighting the importance of sustained ESG integration.

ESG and financial stability (Volatility). Contrary to expectations in the existing literature, the analysis of EBITDA volatility over the 2018–2022 period reveals higher variability among consistent ESG reporters, with an average standard deviation of \$1.38 million, compared to just \$540k for non-reporters and \$189k for single reporters (Table 2).

Table no. 2 Average EBITDA volatility (Standard deviation) by ESG Group (2018–2022)

ESG Group	Avg. EBITDA std. dev (th USD)
Non-reporters	541
Consistent reporters	1,378
Single reporters	189

Source: Orbis

While ESG engagement is typically associated with reduced financial risk and greater stability (Friede et al., 2015), this result may reflect the larger scale of consistent reporters, whose operational complexity and exposure to market dynamics naturally entail higher earnings fluctuations. In contrast, smaller or more static firms—many of which fall into the non-reporting group—may report less volatile EBITDA simply due to limited activity or growth.

This finding suggests that EBITDA volatility must be interpreted in light of firm size and sectoral structure, and that ESG reporting may correlate with more dynamic, growth-oriented corporate profiles, rather than with risk containment alone.

ESG and profitability trends. Profitability, measured by average profit margin, also shows variation across ESG engagement levels (Table 3). While non-reporters exhibited higher margins in the earlier years of the sample, their performance stagnated or declined toward 2022. In contrast, consistent reporters demonstrated a clear upward trajectory—from 4.9% in 2018 to 8.4% in 2022, reflecting more efficient cost structures or stronger pricing power, possibly due to reputational or operational advantages linked to ESG adoption.

Table no. 3 Average profit margin by ESG Group and year (%)

ESG Group	2018	2019	2020	2021	2022
Consistent reporters	4.9	4.7	5.9	7.2	8.4
Non-reporters	6.4	5.6	5.1	6.9	5.5
Single reporters	3.3	2.4	4.3	4.1	4.1

Source: Orbis

Notably, single reporters consistently underperformed, with average margins below 4.3% throughout the period. This suggests that isolated ESG disclosures, absent strategic continuity, may not yield measurable financial benefits.

Overall, the trend supports the hypothesis that long-term ESG commitment enhances not just earnings levels (EBITDA), but also financial efficiency, though the effect appears cumulative and requires sustained implementation.

Sectoral differences. The sectoral analysis confirms that the financial benefits of ESG reporting vary considerably across industries. Generally, consistent ESG reporters outperform other firms, particularly in sectors with high stakeholder pressure, regulatory scrutiny, or intangible assets.

Table no. 4 Average EBITDA and Profit Margin by ESG Group and Sector (2018–2022)

SECTOR	EBITDA (CONSISTENT)	PM (CONSISTENT)	EBITDA (NON- REPORTERS)	PM (NON- REPORTERS)	EBITDA (SINGLE)	PM (SINGLE)
A - AGRICULTURE	7162.29	10.71	1321.50	7.34	-	-
C- MANUFACTURING	6777.97	3.85	1370.12	5.30	814.39	2.49
D - ELECTRICITY	2659.13	21.04	1472.40	7.07	-	-
E - WATER	-	-	325.23	-1.17	-	-
F - CONSTRUCTION	711.67	9.82	1064.29	8.92	-	-
G - WHOLESALE & RETAIL	449.88	1.78	965.44	7.92	669.92	8.22
H- TRANSPORTATION	317.11	4.91	1960.53	3.66	1032.78	1.30
I- ACCOMMODATION	348.92	12.70	-	-	-	-
J - INFORMATION & COMM	8667.56	25.54	1051.39	16.94	-	-
K - FINANCE	-	26.11	-	-	-	-
L - REAL ESTATE	-	-	1639.46	3.31	-	-
M - PROF. ACTIVITIES	5130.20	7.28	-90.91	-15.64	-	-
N - ADMIN SUPPORT	1450.36	9.60	404.22	5.06	-	-
S - OTHER SERVICES	-	-	1382.59	-0.79	-	-

Source: Orbis

The Information and Communication sector stands out, with consistent reporters achieving the highest EBITDA (\$8.67 million) and profit margin (25.54%), suggesting strong alignment between ESG efforts and competitive advantage in innovation-driven fields. Likewise, in the Electricity and Gas sector, ESG adoption correlates with robust financials—profit margins of 21.04% and EBITDA of \$2.66 million—likely due to regulatory alignment and environmental materiality.

In Agriculture, consistent reporters show a notable EBITDA advantage (\$7.16 million vs. \$1.32 million for non-reporters), suggesting that ESG practices are increasingly valued even in primary sectors. However, Manufacturing presents a more mixed picture: while consistent reporters have higher EBITDA, non-reporters slightly outperform in terms of profit margins, indicating potential lag in ESG return realization.

Traditional sectors such as Construction and Wholesale & Retail show smaller but positive effects of ESG consistency, though in some cases (e.g., retail), single or non-reporters outperform in profit margin, likely due to leaner structures or short-term cost focus.

Some sectors highlight the risks of poor ESG alignment. In Professional and Technical Activities, non-reporters show negative profit margins (-15.64%), while consistent reporters remain solid (7.28%). Meanwhile, Transportation sees higher profitability among single reporters than among consistent ESG adopters, possibly due to sector-specific challenges.

High EBITDA volatility among consistent reporters, especially in dynamic sectors like tech and energy, reflects greater scale and market exposure rather than instability.

Overall, ESG disclosure yields the strongest results in sectors where it aligns with core risks and stakeholder expectations. This underscores the need for sector-specific ESG strategies instead of one-size-fits-all approaches.

5. Conclusions

This study offers empirical evidence that consistent ESG reporting can serve as a strategic lever for improving financial performance in emerging markets. Analyzing Romanian firms across diverse sectors, we find that companies with sustained ESG engagement generally report higher EBITDA levels and rising profit margins—especially in sectors where environmental and social factors are financially material. These results suggest that ESG disclosure, when applied consistently and contextually, can enhance not only reputational capital but also operational efficiency.

However, the financial impact of ESG varies across industries, with traditional and capital-intensive sectors showing more subdued effects. This variation underscores the importance of industry-specific ESG strategies, tailored to regulatory frameworks, stakeholder expectations, and organizational capabilities. ESG should therefore be viewed not as a compliance burden, but as a performance-oriented approach that requires both commitment and alignment with sectoral realities.

Our findings have direct implications for corporate decision-makers and policymakers seeking to promote sustainable economic development through transparency and responsible governance.

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The Role of Administrative Digitalization and Economic Development in Shaping Fiscal Efficiency: A Cross-National Analysis

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Abstract

The paper investigates the relationship between government digitalization and economic and fiscal performance in European countries. Two multiple regressions were used with GDP (Gross Domestic Product) per capita and Tax Revenue as Percentage of GDP (TaxGDP) as dependent variables, and EGDI (E-Government Development Index) and EPI (E-Participation Index) as predictors. The results show that EGDI positively and significantly influences the tax share in GDP, while the effect on GDP per capita is not significant. Also, EPI has no significant effect on any of the dependent variables. The study highlights the role of government digitalization in fiscal consolidation, but not in direct economic growth, suggesting the need for integrated e-government and economic development policies. The paper contributes to the specialized literature by clarifying the differential effects of digitalization on macroeconomic indicators.

Key words: government digitalization, digital governance, electronic public services, EGovernment, E-participation

J.E.L. classification: E60

1. Introduction

In recent decades, global society has experienced profound structural transformations generated by the rapid advance of digital technologies. The digitalization process has changed not only the way in which individuals communicate, consume information and interact economically, but also the architecture of public governance and the citizen-state relationship. In this context, the concept of e-government has gained particular importance, reflecting the states capacity to integrate information and communication technology into administrative processes, the provision of public services and the participation of citizens in the decision-making process.

The present paper is part of this thematic framework and investigates the relationship between the digitalization level of government, namely the degree of electronic citizens participation, and macroeconomic indicators such as product per capita and the degree of tax collection compared to GDP, in the European Union member states. The analysis focuses on the European Governance Digitalization Index (EGDI) and the E-Participation Index (EPI), two established international tools for measuring government digitalization, and how they correlate with economic performance.

The motivation derives from the growing relevance of government digitalization in the economic and administrative architecture of modern states. Currently, digitalization is not only a strategy for administrative efficiency, but also a catalyst for economic development, competitiveness, social inclusion and bureaucracy reduction. In the specialized literature, studies on the effects of e-

government on economic development highlight both benefits in terms of administrative efficiency and increased transparency, as well as risks associated with digital divides and cybersecurity (United Nations, 2022; Eurostat, 2024; World Bank, 2024). In Romania, the topic is all the more relevant as the National Recovery and Resilience Plan (PNRR) allocates significant funds for digitalization, and progress still remains below potential compared to the EU average.

The aim of the paper is to analyse the relationships between the government digitalization level (EGDI) and electronic participation (EPI) on the one hand, and macroeconomic indicators (GDP per capita and taxes as a percentage of GDP) on the other hand, in order to understand how digitalization can be a factor of economic and social progress.

The general objective of the research is to empirically investigate the correlations between e-government indicators and selected economic variables, in EU member states, with the aim of providing an integrated perspective on the impact of digitalization on economic performance at the European level.

The research question guiding the paper is formulated as follows: *"To what extent can the government digitalization degree and the e-participation level influence the tax collection degree and the product per capita in EU member states?"*

Starting from this question, the research hypothesis assumes that there is a significant positive relationship between the government digitalization degree (EGDI), the e-participation level (EPI) and product per capita (GDPCapita), respectively taxes collected relative to GDP (TaxGDP).

The paper is structured as follows: the introductory part presents the conceptual framework and motivation of the topic, the main objective, the purpose and the research question. The second chapter provides the theoretical foundation, addressing the relevant definitions, concepts and theories about government digitalization, e-participation and their relationship with economic development. The third chapter details the research methodology, describing the research design, hypotheses, statistical tools used, data sources and methods of collecting and processing them. The multiple linear regression model applied is explicitly presented, as well as the justification for using the EGDI, EPI, GDPCapita and TaxGDP indicators. The fourth chapter presents the research results, including descriptive analyses, Pearson and Spearman correlation tests, regression analysis and the results interpretation, with reporting of statistical significance and coefficient values as well as the integrated interpretation of the results in relation to the specialized literature, practical implications for public digitalization policies. The last chapter presents the conclusions, as well as the limitations of the study and future research directions.

Thus, this paper proposes a rigorous and necessary empirical analysis to understand the impact of government digitalization on economic development, in the context of European integration and the accelerated transition to e-government, offering both a theoretical contribution to the specialized literature and a practical one, with direct relevance for administrative modernization and public policy strategies in Romania and the EU member states.

2. Literature review

Government digitalization and e-government have been topics of increasing interest in the scientific literature over the past two decades, due to the major transformations they have brought to the citizen-state relationship and to administrative processes.

The most cited studies in the field include research from the early and mid-2000s, which laid the conceptual foundations of e-government. For example, Heeks (2006) was one of the pioneers who analysed the impact of information technologies on public sector reform, emphasizing the importance of digital transformation in improving transparency and administrative efficiency. Also, Dunleavy et al. (2006) developed the "digital era governance" model, which conceptualizes the integration of digital technologies into public governance as an essential evolutionary stage for the administration modernization.

Another highly cited study is that of Layne & Lee (2001), who proposed a four-level framework for implementing e-government, from simple static web pages to integrated electronic service systems. These theoretical frameworks were further developed by Moon (2002), who identified the success factors of e-government, including technological infrastructure and organizational culture.

From the perspective of the relationship between e-government and economic performance, West (2005) analysed how digitalization can contribute to increasing government efficiency and stimulating economic development by facilitating access to services and reducing administrative costs. This idea is also supported by Bannister & Connolly (2014), who summarized the role of e-government in promoting transparency, accountability and citizen involvement.

In terms of the most relevant recent studies, literature published in the last five years offers valuable insights into the impact of digitalization in the current context of European and global economies. For example, the link between e-participation and the trust level in institutions has been highlighted, as well as the role of digital governance in supporting the states resilience in the face of crises (Kraemer-Mbula et al., 2020; Janssen & Estevez, 2021).

A key study by Zuiderwijk & Janssen (2019) analyses the barriers and facilitators of the implementation of open and digital government policies, highlighting the importance of digital infrastructure and human capital in the success of these initiatives. Recently, Kettunen & Kallio (2022) explored the role of digital governance in the green and sustainable transition process, indicating the interdependence between technology and effective public policies.

As for the latest studies published between 2022 and 2025, they bring to the fore topics such as artificial intelligence in governance, the impact of the COVID-19 pandemic on the acceleration of digitalization, and the use of big data in decision-making. For example, Nguyen et al. (2023) investigate how governments have used digital platforms to ensure the continuity of public services during the pandemic, highlighting the increase in e-participation and transparency.

As for the latest studies published in the period 2022-2025, they bring to the fore topics such as artificial intelligence in governance, the impact of the COVID-19 pandemic on the acceleration of digitalization, and the use of big data in decision-making. For example, Nguyen et al. (2023) investigate how governments have used digital platforms to ensure the continuity of public services during the pandemic, highlighting the increase in electronic participation and transparency.

Furthermore, Patel & Sharma (2024) analyse the correlation between the digitalization level of public administration and economic performance in EU member states, using a complex econometric models that confirm the positive influence of digitalization on budget revenues and economic development. Also, Chen & Zhang (2025) provide a comparative perspective on digital strategies in Asia and Europe, highlighting the factors that contribute to the success of e-government implementation. These studies reflect the rapid evolution of the field, its practical relevance, and the continuing need for empirical research, especially in the dynamic context of global digitalization and economic transformations. They also support the hypothesis of the present paper that e-participation indicators, tax collection, and GDP per capita are essential factors influencing the level of government digitalization.

3. Research methodology

The present study aims to analyse the relationships between the digitalization government degree, the e-participation level, the tax revenue collection degree and the economic development level in European countries. The research uses secondary data, taken from official international sources, namely the E-Government Development Index (EGDI) and E-Participation Index (EPI) indicators published by the United Nations (2022, 2024), data on tax revenues reported to GDP (TaxGDP) and GDP per capita (GDPCapita) obtained from the Eurostat (2024) and World Bank (2024) databases.

The dataset includes information for a number of 30 European countries for a reference period between 2019 and 2024. For all variables used, the average was calculated for the period considered, taking into account the relative stability of these indicators and their structural nature.

In order to answer the research question, we formulated the following research hypotheses:

H1. *There is a significant positive relationship between the government digitalization degree (EGDI), the e-participation level (EPI) and the GDP per capita.*

To test the hypothesis, the analysis was structured in two stages. In the first stage, Pearson and Spearman correlations were calculated to highlight the existence and direction of associations between variables. In the second stage, multiple linear regression models were estimated to evaluate the influence of independent variables on the government digitalization index.

The proposed regression model has the following general form:

$$GDPCapita = \beta_0 + \beta_1 (EGDI_i) + \beta_2 (EPI_i) + \epsilon_i$$

Where:

β_0 = intercept (constant)

β_1 = effect of EGDI on GDP per capita

β_2 = effect of EPI on GDP per capita

ϵ_i = residual error

H2. *There is a significant positive relationship between the government digitalization degree (EGDI), the e-participation level (EPI) and the Tax Revenue as Percentage of GDP.*

$$TaxGDP = \beta_0 + \beta_1 (EGDI_i) + \beta_2 (EPI_i) + \epsilon_i$$

Where:

β_0 = intercept (constant)

β_1 = effect of EGDI on the level of taxes collected relative to GDP

β_2 = effect of EPI on the level of taxes collected relative to GDP

ϵ_i = residual error

The estimates were made using the SPSS statistical package, testing the hypotheses regarding the statistical significance of the coefficients and the overall model quality. The validity conditions of the multiple regression were also verified, namely the normality of the residuals, linearity, homoscedasticity and the lack of multicollinearity.

Through this methodological approach, the research aims to clarify the extent to which the economic development level and the capacity to collect tax revenues explain the variations in the degree of digitalization of public administration and, complementary, the role of citizen participation in digital governance processes. The results obtained will allow the formulation of conclusions regarding digital and fiscal convergence in the European space, with implications for the development of public policies.

4. Results and discussion

The descriptive analysis highlighted the following: the average of the EGDI index is 0.859, with a low standard deviation (0.063), confirming a high and homogeneous level of government digitalization in the EU. GDP per capita has a relatively high dispersion, suggesting economic variation between countries. The average GDP per capita in the analysed sample is 47,000 USD, with a standard deviation of 22,436 USD, highlighting a substantial variation between the analysed states. The average for the EGDI is 0.859, indicating a high level of e-government development on average in Europe. And the average tax share in GDP (TaxGdp) for the analysed European states is 36.01%, with a standard deviation of 5.71%, indicating moderate variations between states in terms of fiscal pressure. The average EPI index is 0.729, with a standard deviation of 0.1117, indicating a high level of electronic citizen participation, with moderate variations between states.

Table no. 1 Correlation Matrix with Pearson and Spearman Correlation Coefficients and Significance Levels

CORELATIONS	Pearson	Sig. Pearson	Spearman	Sig. Spearman
EGDI - EPI	0,697	< 0,001	0,752	< 0,001
EGDI – TaxGdp	0,549	0,003	0,553	0,003
EGDI – GDPCapita	0,529	0,003	0,703	< 0,001
EPI – TaxGdp	0,274	0,166	0,413	0,032
EPI – GDPCapita	0,345	0,084	0,571	0,002
TaxGdp – GDPCapita	0,242	0,233	0,571	0,002

Source: made by authors

Pearson correlation analysis revealed a strong positive relationship between EGDI and EPI ($r=0.697$, $p<0.001$), as well as moderate correlations between EGDI and TaxGdp ($r=0.549$, $p=0.003$), respectively GDPCapita ($r=0.529$, $p=0.003$). Spearman correlations confirmed these results, indicating a strong monotonic association between the same variables, EGDI and GDPCapita having $\rho=0.703$ ($p<0.001$). These results suggest that a higher level of government digitalization is associated with a higher GDP per capita and a higher tax-to-GDP ratio, potentially reflecting both institutional capacity and the level of economic development. The explanation may be that digitalization facilitates the efficiency of tax collection, reduces evasion and optimizes voluntary compliance.

The weak positive correlation between TaxGdp and EPI, which is not statistically significant, indicates that the e-participation level does not have a direct effect on Tax Revenue as Percentage of GDP, but the direction of the relationship is positive.

There is a strong and significant correlation between EGDI and EPI ($r = 0.697$, $p < 0.001$), which suggests that countries with a developed digital government offer even more opportunities for e-participation for citizens.

The data analysis aimed to examine the effect of the e-Government Index (EGDI) and the e-Participation Index (EPI) on two dependent variables: GDP per capita (GDPCapita) and the Tax Revenue as Percentage of GDP (TaxGdp). Two multiple regression models were conducted, one for each dependent variable, to highlight how the degree of government digitalization and citizen participation through digital platforms influence the economic and fiscal performance in the analysed countries

Table no. 2 Multiple Regression Analysis Results Predicting GDP per Capita

	R	R Square	Adjusted R ²	Std.Beta	Std. Error	UnStd. Beta	t	VIF	F change
Constant/ GDPCapita	0,427	0,182	0,111		18.484,869	-62.852,04	-		2,564
EGDI				0,345	82.035,85	109.519,37	1,187	1,879	
EPI				0,109	48.301,79	20.358,84	0,421	1,879	

Source: made by authors

In the first model, with GDPCapita as the dependent variable and EGDI and EPI as predictors, the results can be summarized as follows: $R^2 = 0.182$, which indicates that the model explains 18.2% of the variation in GDP per capita. Although this percentage is not high, it reflects a modest contribution of the two indicators to explaining the differences between countries. The ANOVA test shows that the overall model is not significant at the 0.05 threshold ($F = 2.564$, $p = 0.099$), but it is borderline and can be considered exploratory relevant, given the sample size and the nature of the macroeconomic variables.

The regression coefficients show that on the one hand, EGDI has a positive effect on GDP per capita ($B = 109,519$ USD, $p = 0.195$), but this effect is not statistically significant in the multivariable model, while EPI has a positive, but very weak and insignificant effect ($B = 20,358$ USD, $p = 0.677$).

The VIF value is below 2 (1.879) for both predictors, indicating the absence of severe collinearity problems, and the Durbin-Watson is 2.149, signalling the lack of autocorrelation of the residuals.

These results suggest that government digitalization (EGDI) is positively and moderately correlated with the GDP per capita, but the results do not allow the generalization of this relationship due to the lack of strict statistical significance, but they strengthen the theoretical arguments regarding the importance of digital transformation in increasing economic efficiency, transparency and investment attractiveness (Venkatesh et al., 2016; United Nations, 2022).

The regression model highlights the existence of a cluster of macroeconomic or structural factors that can explain the variation in GDP per capita (education, innovation, labour productivity). Therefore, integrating other variables in future analyses could provide a more complete picture of the determinants for sustainable economic development in the EU.

Table no. 3 Multiple Regression Analysis Results Predicting TaxGDP

	R	R Square	Adjusted R ²	Std.Beta	Std. Error	UnStd. Beta	t	VIF	F change
Constant/ TaxGDP	0,569	0,324	0,268		13,948	-11,186	-0,802		5,758
EGDI				0,696	21,598	64,222	2,974	1,947	
EPI				-0,211	11,974	-10,793	-0,901	1,947	

Source: made by authors

The second multiple regression model has TaxGdp as the dependent variable and EGDI and EPI predictors. The results, $R^2 = 0.324$, indicate that 32.4% of the variation in the Tax Revenue as Percentage of GDP is explained by the level of government digitalization and e-participation.

The model is statistically significant ($F = 5.758$, $p = 0.009$), suggesting that at least one of the included predictors contributes significantly to explaining the variation in TaxGdp.

EGDI has a positive and significant effect on TaxGdp ($B = 64.222$, $p = 0.007$). Thus, a one-unit increase in the EGDI index (theoretically from 0 to 1) would be associated with an increase in the Tax Revenue as Percentage of GDP of approximately 64.2 percentage points. In practice, marginal increases in EGDI lead to improvements in tax efficiency, in line with recent literature (Gupta et al., 2021; United Nations, 2022).

EPI has a negative coefficient ($B = -10.793$), but this effect is not statistically significant ($p = 0.376$). This indicates that although e-participation is correlated with overall digitalization, it does not directly influence the Tax Revenue as Percentage of GDP.

VIF values are below 2 (1.947), indicating the absence of multivariate collinearity between predictors.

Durbin-Watson value is 2.252, suggesting the lack of autocorrelation of the residuals and, implicitly, the adequacy of the estimated model.

These results reveal that the public services digitalization and the e-administrative infrastructure contribute more to increasing fiscal efficiency than to directly boosting economic performance measured by GDP per capita.

The integrated interpretation of the two models suggests that e-government, measured by EGDI, has clearer positive effects on fiscal consolidation than on immediate economic development, but there are indications of a positive effect on GDP per capita as well, even if insignificant in the current model. E-participation, although correlated with EGDI, does not prove to be a significant predictor in any of the models tested, which could be explained by the fact that the mere possibility of citizens to interact digitally with the administration does not necessarily imply direct economic and fiscal effects. This is in line with recent literature, which emphasizes that e-participation is rather a catalyst for democratic governance and transparency (United Nations, 2022), and its economic effects require a mature institutional context and coherent digital integration policies.

In light of these results, it can be concluded that investments in e-government infrastructure have the potential to support fiscal sustainability by making public revenue collection more efficient and improving tax compliance. At the same time, the indirect effects on overall economic development require further exploration, as relationships mediated by factors such as digital human capital, the investment climate and the quality of institutions are possible.

The results of the study are relevant for public decision-makers in the analysed countries, as they highlight the importance of e-government not only as a tool for administrative modernization, but also as a driver of fiscal consolidation and, potentially, sustainable economic development.

5. Conclusions

The present study explored the impact of the e-Government Index (EGDI) and the e-Participation Index (EPI) on GDP per capita and the tax-to-GDP ratio in European countries. Analysis through two separate multiple regression models revealed that the EGDI has a significant positive effect on the tax-to-GDP ratio, suggesting that the digitalization of public services contributes to the efficiency of tax collection and the increase in the degree of voluntary compliance. In the case of GDP per

capita, the EGDI effect was positive, but not statistically significant, indicating that the benefits of administrative digitalization on the national economy may take longer to manifest. The e-Participation (EPI) did not prove to be a significant predictor in any of the models tested, highlighting that the mere existence of e-participation tools does not automatically generate direct economic or fiscal effects, in the absence of an integrated strategic use.

From an academic perspective, the study extends the literature on government digitalization by demonstrating the direct relationship with national fiscal performance. Managerially, the results suggest that e-government policies should be prioritized in the fiscal modernization strategy, to increase the degree of collection and transparency, with potential effects on budgetary consolidation. At the same time, the development of e-participation components should be aligned with institutional objectives to ensure a concrete impact.

The main limitations consist of the small sample size and the absence of control variables such as political stability, the digital education degree and institutional quality. In addition, the cross-sectional design does not capture the dynamic effects of digitalization over time.

To strengthen the conclusions, future research should use panel data and integrate relevant control factors. At the same time, it is recommended to apply Structural Equation Modeling (SEM) models to test the direct, indirect and moderate effects between digitalization, fiscal efficiency and sustainable economic development. Extending the analysis to a global level and investigating the relationship between e-participation, citizen trust and governance quality would provide an integrated perspective on public digitalization.

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Democracy, Trust and Taxes: Does Fiscal Equity Matter for Civic Engagement?

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Abstract

The study analyses the relationship between objective tax fairness and civic engagement in the EU Member States. Using the turnout rate in the 2024 European Parliament elections as an indicator of civic spirit and constructing a composite indicator of objective tax fairness (tax burden, indirect tax share and VAT Gap), the research estimated simple and multiple regressions. The results show that a higher tax burden is associated with higher levels of electoral participation, while a higher share of indirect taxes in GDP has a negative effect on civic engagement. The VAT Gap does not significantly influence participation. The conclusions underline the importance of the structure of the tax system in strengthening social cohesion and suggest that a system perceived as fairer stimulates citizens' participation in democratic life.

Key words: fiscal equity, civic engagement, democracy, taxes, European Parliament election

J.E.L. classification: D72

1. Introduction

In recent decades, the European Union has gone through complex processes of democratic consolidation, fiscal uniformity and socio-political integration, but the degree of its citizens' civic engagement varies significantly from one Member State to another. Voting participation, as a fundamental form of civic engagement, remains a central indicator of democratic health. At the same time, citizens' trust in institutions and the perception of the tax system fairness contribute to the democratic regime legitimacy and to the social capital consolidation. In this context, it becomes essential to explore the interactions between fiscal fairness and civic behavior, especially electoral participation.

The literature has consistently highlighted the link between tax fairness and compliance (Tyler, 1990; Feld & Frey, 2007), but also between trust in institutions and electoral participation (Putnam, 1993; Norris, 2011). However, the relationship between tax fairness – understood as both effective redistribution and the perception of tax fairness – and civic engagement is insufficiently explored in a comparative European context. Beyond simple correlations between the level of taxation and voter turnout, a broader analysis is needed that integrates objective indicators of tax fairness (e.g. tax level as a % of GDP, system progressivity, VAT collection efficiency, post-tax Gini coefficient) and indicators of civic spirit such as participation in European parliamentary elections, relevant in the context of European integration and the legitimacy of supranational institutions.

Against the backdrop of the general decline in voter turnout in many Member States and the increasing perception of fiscal inequity in contexts of economic, social and political crises, this paper aims to answer a fundamental question: *Does fiscal fairness matter for the civic engagement of European citizens?*

The main objective of this study is to empirically examine the relationship between fiscal fairness and civic spirit, operationalized by the participation rate in the last European Parliament elections (2024). *The purpose* of the research is twofold: on the one hand, an analytical one – to determine to what extent fiscal fairness (measured by a composite set of indicators) can explain the variation in civic engagement between EU Member States, and, on the other hand, an applicative one – to contribute to the substantiation of fiscal and civic policies aimed at strengthening public trust and increasing democratic participation.

The present study makes an innovative contribution to the literature on the relationship between tax equity and civic engagement in the context of the European Union. First, the research proposes a composite approach to measuring objective tax equity, integrating three essential indicators:

- Tax burden (% GDP) – as a measure of the tax system's capacity to collect public revenues and the pressure exerted on taxpayers.
- Share of direct taxes in total tax revenues (%) – as a proxy for the progressivity of the tax structure and the degree of redistribution.
- VAT Gap (%) – as an indicator of the efficiency of VAT collection, reflecting horizontal equity (in conditions where honest taxpayers bear the costs of tax evasion for others).

Existing literature has used these indicators independently in analyses of collection efficiency (Loughead et al., 2020), tax progressivity (Martinez-Vazquez et al., 2012) or the relationship between tax revenues and civic engagement (Prichard et al., 2019). However, no study has integrated these three dimensions into a single composite indicator of tax equity.

Thus, the first major contribution of the study consists in proposing and operationalizing this composite indicator of objective tax equity, with potential for application in both academic analyses and in the evaluation of public tax policies at the European level.

Second, the research extends the literature on the effects of tax fairness on civic engagement, as measured by turnout in European Parliament elections. While most studies have focused on the perception of tax fairness (Fair Tax Perception) and its link to tax compliance (Kornhauser, 2007; Wenzel, 2004), the present study uses electoral participation as an indicator of general civic engagement and tests the effect of objective predictors of tax fairness on it, through a multiple regression, modelling voting participation as the dependent variable.

This approach aligns with fiscal contract theories (Prichard et al., 2019; Luttmer & Singhal, 2014), according to which citizens respond to the quality of governance and the fairness of the tax system through the level of civic engagement, including electoral participation.

Third, the analysis is carried out on a complete data set for EU Member States, for the period 2019–2023 (for fiscal indicators) and 2024 (for electoral participation), which allows testing the hypotheses in a robust international comparative context. The construction of the multiple regression model with standardized variables and the interpretation of the coefficients in the context of structural differences between states brings added value to the existing literature, mostly based on national case studies.

Therefore, the research *main scientific contributions* are: the development of an innovative composite indicator of objective fiscal fairness, integrating the tax burden, the tax structure and the VAT Gap, the empirical testing of the relationship between objective fiscal fairness and civic spirit, conceptualized as voting participation, in a pan-European analytical framework, the extension of the fiscal contract theory by demonstrating the potential predictor of objective fiscal fairness on civic involvement, going beyond the exclusive focus on subjective perceptions.

These contributions offer both a new theoretical perspective on the link between fiscal fairness and civic engagement, as well as practical implications for fiscal and democratic governance policies in the EU, in the context of growing distrust in European institutions and declining electoral participation in some Member States.

The paper is structured in five interrelated chapters: the introduction presents the context, issues, motivation and objectives; chapter two summarizes the literature on fiscal fairness, institutional trust and electoral participation, highlighting existing gaps; the methodological chapter describes the

comparative design on EU-27 states, data sources, variables and statistical analysis in SPSS; chapter four presents the results and related discussions, with the interpretation of regression coefficients and theoretical implications; and the last chapter synthesizes the conclusions, limitations of the study and recommendations for European public policies.

Through this structure, the present paper offers a relevant theoretical and empirical contribution to understanding the mechanisms through which fiscal equity influences civic participation. The results will be useful both for the academic literature on political economy and fiscal sociology, and for the formulation of public policies aimed at strengthening trust and democracy in contemporary Europe.

2. Theoretical background

The relationship between fiscal equity and civic engagement is an interdisciplinary field that draws on perspectives from political economy, sociology, political science, and social psychology. Beyond the simple collection of taxes, tax systems are essentially social contracts that reflect citizens' perceptions of justice, trust in institutions, and redistributive equity, elements that profoundly influence the level of civic engagement. This conceptual framework has traditionally been approached through the lens of social capital, trust theories, and democratic participation, but recent research has begun to systematically explore the link between fiscal equity and electoral participation at a comparative level.

Beginning with the seminal work of Putnam (1994), who illustrated how social capital influences institutional performance and citizen engagement, emphasis has been placed on the importance of communities characterized by social norms and mutual trust for the proper functioning of democracy. This perspective was amplified by Tyler (2006), who demonstrated that the perception of procedural fairness is an essential condition for normative compliance, including in the tax domain. His work remains a landmark in understanding how perceived legitimacy of institutions can generate prosocial behaviours, including tax payment and electoral participation.

In the same vein, Feld and Frey (2007) developed the concept of the "moral fiscal contract", emphasizing that citizens' attitudes towards taxation depend not only on economic sanctions and incentives, but also on the perception of a fair and transparent tax system. Through this theoretical framework, the authors highlighted how trust in government and the fairness of the tax system play central roles in citizens' motivation to comply with tax obligations. Thus, tax fairness is not just a technical issue, but a social phenomenon with profound democratic implications.

Empirical studies have confirmed these theories. Feld & Matsusaka (2003) showed, by analysing data from the Swiss canton, how direct democratic mechanisms, such as budget referendums, can lead to more responsible spending of public resources and, implicitly, to a greater perception of fiscal fairness. This, consequently, increases citizens' commitment to the democratic process and tax compliance. Matsusaka (2023) continues this line, exploring the effects of fiscal democratization on social groups, such as corporations and unions, revealing the multiple dimensions of civic engagement in the context of fiscal policies.

An important trend in recent research is the emphasis on local civic participation and direct citizen involvement in the budget process. Feld and Frey (2007) highlighted, in their analysis of Brazil, that participatory institutions in governance can reduce tax evasion and increase citizens' trust in public administration. This constitutes evidence that effective citizen involvement in tax decisions has a positive impact on tax behaviour and civic spirit. Aziz & Shah (2020), in a detailed review of participatory models, emphasize that participatory budgeting and other forms of direct involvement are essential tools for building a tax system that is perceived as fair.

Also, in recent years, research has begun to integrate the technological dimension into the study of civic engagement and tax fairness. McCord and Becker (2023) investigated the role of civic technologies in promoting transparency and strengthening institutional trust in Canada, revealing their potential in facilitating democratic participation and, indirectly, in increasing the perception of tax fairness. In the same vein, the OECD report from 2025 emphasizes the importance of protecting civic space and promoting an inclusive democratic environment for the development of active citizen participation in governance and tax processes.

At the European level, the European Commission (2024) highlights, in its recent strategy for strengthening democracy, the role of economic fairness as a means of combating populism and strengthening electoral participation, an essential aspect in the context of the European Parliament elections. The Committee of the Regions' report (2024) also highlights the contribution of artificial intelligence and digital technologies in promoting civic engagement, in particular among young people and underrepresented groups, by guaranteeing transparent and fair processes.

These studies highlight that the perception of fiscal fairness is not just a simple technical attribute, but a social construct that influences citizens' trust and participation in democratic processes. Furthermore, it has been noted that direct forms of fiscal democracy, such as budget participation or referendums, increase both the perception of fairness and civic engagement, generating a virtuous circle between fiscal legitimacy and democratic engagement.

However, the contemporary literature points to a number of gaps, especially in terms of comparative studies at the European Union level that integrate both objective indicators of fiscal equity (progressiveness of the tax system, tax level, Gini coefficient after taxation) and behavioral indicators of civic spirit, such as participation in European parliamentary elections. The integrative approach proposed by this study aims to fill this gap, offering a complex perspective on how fiscal equity is reflected in civic behaviour in various European contexts.

Thus, from the perspective of the specialized literature, it can be concluded that fiscal equity is a necessary condition – although not sufficient – for increasing civic involvement, and its consolidation requires a concerted effort to reform fiscal policies, accompanied by measures that increase transparency, accountability and inclusion of citizens in the decision-making process.

3. Research methodology

This research aims to analyse the relationship between fiscal fairness and civic spirit at the level of the European Union Member States, by using relevant indicators for the period 2019-2023. The adopted methodology combines the collection and processing of secondary data with quantitative statistical analysis techniques, in order to highlight the influence of fiscal fairness on civic participation.

Selection of indicators and data collection

To measure fiscal fairness, three objective, relevant and available indicators were selected for all EU Member States in the period 2019-2023, an interval chosen to reflect the fiscal situation prior to the 2024 European Parliament elections. These indicators were extracted from the official platforms of European and international institutions, such as Eurostat, OECD, European Commission and, thus ensuring the validity and comparability of data at regional level.

The selected indicators include:

- Tax burden (share of taxes in GDP)
- Share of indirect taxes in total tax revenues (% of GDP)
- VAT GAP (percentage indicator)

For each indicator, the normalized arithmetic mean was calculated for the period 2019 – 2023.

Based on the specialized literature on the relationship between tax equity and civic engagement (Prichard et al., 2019; Luttmer & Singhal, 2014), as well as on the theory of the fiscal contract, the study proposes to test the following research hypotheses:

H1: *There is a negative relationship between the tax burden (% GDP) and the participation rate in the European Parliament elections*

H2: *There is a negative relationship between the share of indirect taxes in total tax revenues (%) and the participation rate in the European Parliament elections*

H3: *There is a negative relationship between the VAT Gap (%) and the participation rate in the European Parliament elections*

H4: *There is a negative relationship between the composite indicator of objective tax equity and the participation rate in the European Parliament elections. A higher composite score reflects a lower level of tax equity, which may erode citizens' trust in tax institutions and collective responsibility and, implicitly, the level of civic involvement.*

Starting from these research hypotheses, we propose the following **statistical model**:
General model H1 – H3:

$$\begin{aligned} Participation_i &= \beta_0 + \beta_1 (Fiscal\ Burden_i) + \epsilon_i \\ Participation_i &= \beta_0 + \beta_2 (ShareIndirectTaxes_i) + \epsilon_i \\ Participation_i &= \beta_0 + \beta_3 (VATGap_i) + \epsilon_i \end{aligned}$$

Where:

Participation_i = voter turnout rate in state i

β_0 = intercept (constant)

β_1 = regression coefficient for the predictor Fiscal Burden

β_2 = regression coefficient for the predictor Share Indirect Taxes

β_3 = regression coefficient for the predictor VAT Gap

ϵ_i = residual error

hypothesis supports $\beta_1, \beta_2, \beta_3 < 0$

Construction of fiscal fairness composite indicator

To synthesize the complex influence of these fiscal dimensions, a composite indicator of fiscal fairness was constructed. It was calculated by aggregating the normalized arithmetic mean of the three indicators selected for each EU member state. Normalization was performed to ensure the comparability of the scales and to avoid the predominance of one indicator over the others in the final composition.

The composite indicator thus obtained reflects a unitary score for each country, which expresses its average degree of fiscal fairness in the reference period.

Measuring civic spirit

For the dependent variable reflecting civic spirit, participation rates in the 2024 European Parliament elections, the last European parliamentary elections, were chosen. These data are recognized as relevant indicators of civic involvement at the national level, being correlated with the level of trust and civic responsibility. The normalized mean was also used for this indicator.

In a first step, to assess the impact of fiscal equity on civic participation, we estimated a simple linear regression, having as predictor the composite indicator of objective fiscal equity and as dependent variable the participation rate in the European Parliament elections.

$$Participation_i = \beta_0 + \beta_4 (ObjectiveFiscal\ Equity_i) + \epsilon_i$$

where:

Participation_i = voter turnout rate within each European state

β_0 = intercept (constant)

β_4 = regression coefficient for each objective predictor of fiscal equity

ϵ_i = residual error

a negative coefficient ($\beta_1, \beta_2, \beta_3 < 0$) supports the hypothesis that a lower level of fiscal equity reduces civic participation.

To investigate in more detail the influence of each component indicator of tax equity, we extended the analysis to a multiple linear regression model, including separately the three tax indicators (tax burden, indirect tax share and VAT Gap) as independent variables. Thus, the proposed statistical model is:

$$Participation_i = \beta_0 + \beta_1 (Fiscal\ Burden_i) + \beta_2 (ShareIndirectTaxes_i) + \beta_3 (VATGap_i) + \epsilon_i$$

Where:

Participation_i = voter turnout rate in state i

β_0 = intercept (constant)

β_1 = regression coefficient for the predictor Fiscal Burden

β_2 = regression coefficient for the predictor Share Indirect Taxes

β_3 = regression coefficient for the predictor VAT Gap

ϵ_i = residual error

hypothesis supports $\beta_1, \beta_2, \beta_3 < 0$

Through this multiple regression model, the individual and combined effect of each fiscal dimension on civic participation is evaluated, controlling for the influence of the other predictors in the model. A negative coefficient of each predictor would support the formulated research hypotheses.

The analysis of the relationship between fiscal equity (predictor) and civic spirit (dependent variable) was carried out in the SPSS program, using statistical methods: Pearson correlation analysis – to evaluate the intensity and direction of the linear relationship between the composite indicator of fiscal equity and the average participation in the European parliamentary elections, respectively simple and multiple linear regression analyses – to investigate the explanatory power of fiscal equity on the variation of civic spirit between states, estimating the regression coefficient and the statistical significance of the model.

To assess the robustness of the estimated multiple regression model, the analysis was performed using the indicators in normalized form, so that the coefficients are directly comparable. At the same time, we checked the consistency of the results when using raw (non-normalized) values, obtaining the same sign and statistical significance relationships for the included predictors. This approach confirms the stability of the estimated effects, regardless of the form of the variables introduced in the model.

These methods allow both the descriptive assessment of the associations and the inference on the predictive influence of fiscal equity on electoral participation.

Table no. 1 Burden, Tax Structure, VAT Gap, Objective Fiscal Equity, and 2024 European Parliament Participation Rates by EU Country

No.	Country	Fiscal Burden	Share Indirect Taxes	VAT Gap	Objective Fiscal Equity	EP 2024 Participation
1	Austria	43.48	14.1	6.63	1.44	56.25
2	Belgium	45.22	13.1	10.55	1.60	89.01
3	Bulgaria	30.50	15.4	6.04	0.99	33.78
4	Croatia	37.60	19.6	10.07	1.72	21.35
5	Cyprus	36.32	14.0	4.92	1.09	58.86
6	Czechia	34.74	11.3	8.92	1.00	36.45
7	Denmark	46.20	15.0	6.33	1.59	58.25
8	Estonia	33.56	13.8	4.49	0.95	37.64
9	Finland	42.92	14.7	4.89	1.39	40.38
10	France	46.96	16.7	8.40	1.82	51.49
11	Germania	41.36	11.0	6.10	1.13	64.74
12	Greece	41.58	17.6	19.97	2.14	41.24
13	Hungary	35.18	17.9	6.07	1.35	59.46
14	Ireland	21.44	6.7	8.05	0.14	50.65
15	Italy	42.30	14.2	13.27	1.67	48.31
16	Latvia	32.96	14.8	8.50	1.15	33.82
17	Lithuania	31.78	12.0	15.49	1.20	28.97
18	Luxembourg	40.76	11.9	9.01	1.28	82.29
19	Malta	28.56	10.0	21.71	1.19	72.98
20	Netherlands	39.46	12.3	4.60	1.08	46.18
21	Poland	35.94	14.3	10.31	1.30	40.65
22	Portugal	37.44	15.0	7.47	1.30	36.47
23	Romania	27.20	10.6	29.25	1.49	52.40
24	Slovakia	34.98	12.2	13.18	1.24	34.38

25	Slovenia	38.18	13.7	8.04	1.26	41.80
26	Spain	37.02	11.7	7.84	1.08	46.39
27	Sweden	43.16	21.7	5.27	1.88	53.39
28	UE Mean	40.80	13.5	9.30	1.41	50.74

Source: made by authors

The adopted methodology emphasizes the objectivity of the indicators and the comparability of data at the European level, but certain *inherent limitations* are recognized: the average of the fiscal indicators for the years 2019-2023 may mask important annual variations, but it offers a stable and representative perspective for the analysis of the medium-term correlation:

- using the turnout rate in European elections as a proxy for civic engagement has the advantage of official and comparable data, but it can also be influenced by political factors or the context specific to each election.

- the aggregate composite indicator reduces the complexity of the tax system to a single variable, which may hide certain country-specific particularities.

Nevertheless, the methodology provides a solid basis for assessing the general relationship between tax fairness and civic engagement in the context of the European Union.

4. Findings

Table no. 2 Descriptive Statistics and Regression Coefficients for Fiscal Equity Indicators and Civic Participation

	Mean	Std. Deviation	Pearson	Sig. (2-tailed) Pearson	Spearman	Sig. (2-tailed) Spearman
Fiscal Burden	0.6264	0.23635	0.270	0.164	0.373	0.050
Share Indirect Taxes	0.4775	0.20328	-0.234	0.230	-0.222	0.256
VAT Gap	0.2136	0.23174	0.049	0.804	-0.074	0.707
Objective Fiscal Equity	1.3171	0.37239	0.073	0.355	0.212	0.278
EP 2024 Participation	0.4057	0.22932	1		1	

Source: made by authors

The bivariate correlation analysis highlighted the relationships between the three fiscal indicators, the composite objective fiscal equity indicator and the turnout rate in the 2024 European Parliament elections. Regarding the tax burden, the Pearson coefficient indicated a positive correlation of 0.270, but this is not statistically significant ($p = 0.164$). However, the Spearman coefficient revealed a stronger positive correlation of 0.373, located at the 5% significance level ($p = 0.050$), suggesting the existence of a weak monotonic relationship between the tax burden and civic participation.

For the share of indirect taxes in total tax revenues, the correlation coefficients were negative, in line with the hypothesis, but lacking statistical significance. Thus, the Pearson coefficient was -0.234 ($p = 0.230$), and the Spearman coefficient was -0.222 ($p = 0.256$), indicating a weak and insignificant association between this indicator and the participation rate.

The VAT Gap analysis did not reveal any significant relationship with civic spirit, the Pearson coefficient being 0.049 ($p = 0.804$), and the Spearman coefficient -0.074 ($p = 0.707$), both suggesting a very weak and statistically insignificant association.

Regarding the composite indicator of objective tax equity, the results showed a positive correlation, with a Pearson coefficient of 0.073 ($p = 0.711$) and a Spearman coefficient of 0.212 ($p = 0.278$), both insignificant. The positive direction of this relationship contradicts the initial hypothesis, which predicted a negative relationship, assuming that a fairer tax system (reflected by lower values of the indicator) would be associated with higher civic participation.

The preliminary results of the correlations do not provide significant support for the hypotheses formulated. The observed relationships are generally weak, and the statistical significances do not reach conventional thresholds, which suggests the need to extend the analysis through simple and multiple linear regressions to assess the real explanatory power of these indicators on civic spirit at the level of EU Member States.

Table no. 3 Simple Linear Regression Results for Normalized Objective Fiscal Equity as Predictor of 2024 European Parliament Participation

Predictor	Unstandar dized B	R Square	Adjusted R Square	STd Error of the Estimate	F change	Sig	Coff. Std. Error	Standardiz ed Coeff	t	VIF
Normalized objective fiscal equity	0.045	0.005	-0.033	0.23306	0.140	0.711	0.120	0.73	0.375	1.000
Constant	0.346	-	-	-	-	0.45	0.165	-	2.103	-

Source: made by authors

Simple linear regression was used to assess the relationship between normalized objective fiscal equity and participation in the 2024 European Parliament elections. The model was not statistically significant, explaining only 0.5% of the variation in participation ($R^2 = 0.005$, Adjusted $R^2 = -0.033$, $F(1,26) = 0.140$, $p = 0.711$). The unstandardized coefficient for the predictor was 0.045, indicating a very weak, statistically insignificant positive relationship ($\beta = 0.073$, $t = 0.375$, $p = 0.711$). The intercept of the model was 0.346 ($t = 2.103$, $p = 0.045$), suggesting the average value of participation when the predictor is zero. VIF values indicated the absence of collinearity ($VIF = 1.000$). In conclusion, normalized objective fiscal equity does not appear to significantly influence the level of civic participation within this simple model.

In the following analysis, a multiple linear regression model was estimated to assess the impact of fiscal equity indicators on civic participation, measured by the normalized participation rate in the 2024 European Parliament elections. The model includes as predictors the normalized tax burden (% GDP), the share of indirect taxes in GDP and the normalized VAT Gap.

Table no. 4 Multiple Linear Regression Results for Fiscal Burden, Share of Indirect Taxes, and VAT Gap as Predictors of 2024 European Parliament Participation

Predictor	Unstandar dized B	R Square	Adjusted R Square	STd Error of the Estimate	F change	Sg	Coff. Std. Error	Standardize d Coeff Beta	t	VIF
Constant	0.300	0.277	0.187	0.20676	3.072	0.052	0.147	-	2.045	-
Fiscal Burden	0.555					0.012	0.204	0.572	2.718	1.470
Share Indirect Taxes	- 0.563					0.022	0.230	- 0.499	- 2.451	1.375
VAT Gap	0.124					0.508	0.184	0.125	0.672	1.148

Source: made by authors

The summary results of the model indicate an R square of 0.277, which means that approximately 28% of the variation in civic participation is explained by the three predictors included. Adjusted for the number of predictors, the R square drops to 0.187, indicating modest explanatory power. The model's F is 3.072, with a significance level of 0.047, suggesting that the model is significant overall at the 5% significance level.

Analysis of the individual coefficients shows that the normalized tax burden has a significant positive effect on participation, with an unstandardized coefficient of 0.555 ($p=0.012$). Thus, a one-unit increase in the normalized tax burden is associated with an increase in civic participation of approximately 0.56 standardized units, controlling for the other predictors. This result contradicts the initial hypothesis, which predicted a negative relationship between tax burden and civic participation, assuming that a higher burden discourages citizen involvement.

In the case of the share of indirect taxes, the coefficient is negative and statistically significant ($B = -0.563$, $p=0.022$), confirming the hypothesis that a higher share of indirect taxes in GDP reduces the level of civic participation. This negative effect suggests that more regressive tax regimes, in which indirect taxes have a high share, may have an inhibitory effect on citizen involvement in electoral processes.

For the VAT Gap, the estimated coefficient is positive, but insignificant ($B = 0.124$, $p=0.508$), indicating that differences in the level of tax compliance do not seem to have a significant impact on civic participation, at least in the context of the estimated model.

The collinearity diagnosis does not indicate major problems, with tolerances all above 0.6 and VIF values below the critical threshold of 2, suggesting that the predictors do not present problematic collinearity. The Durbin-Watson index has a value of 2.137, indicating the lack of autocorrelation of the residuals.

The multiple regression results show that the share of indirect taxes has a significant negative effect on civic participation, while the total tax burden exerts a significant positive effect, contrary to theoretical expectations. The VAT Gap has no significant influence. The explanatory power of the model remains moderate, suggesting that other structural or cultural factors contribute to the variations in civic involvement among EU Member States.

The results obtained partially contradict the theoretical expectations formulated earlier. First, the significant positive effect of the tax burden on civic participation suggests that, in the European context, a higher tax burden is not necessarily perceived as an excessive burden that inhibits participation, but may reflect a higher administrative and institutional capacity, correlated with citizens' trust in the state and a strengthened civic culture. Thus, in countries with high tax collection relative to GDP, citizens may consider their participation to have a direct effect on the quality of governance, which stimulates voter turnout.

In contrast, high indirect tax burdens are negatively associated with participation, consistent with literature that highlights the regressive effects and perceived inequity of this type of taxation (Prichard, 2015). Indirect taxes disproportionately affect lower incomes, which can lead to civic demotivation and the perception that the tax system is unfair, thus reducing citizens' willingness to engage politically.

The VAT Gap did not have a significant effect, suggesting that levels of tax compliance do not directly influence electoral mobilization. It is possible that this indicator reflects administrative and structural issues rather than aspects directly perceived by citizens, being less visible and therefore less relevant to voting behaviour.

The results indicate that the structure of taxes influences civic electoral behaviour: high direct taxation correlates with higher participation, while reliance on indirect taxes discourages involvement. Thus, the perceived fairness of the tax system, especially in its distributive component, seems to play an important role in the electoral mobilization of citizens. Overall, the tested model explains only part of the variation in civic participation, which confirms that citizen involvement is a multidimensional phenomenon, influenced by cultural, historical, socio-economic and institutional factors, in addition to the characteristics of the tax system.

The presented analysis has several important limitations. First, using the turnout rate in the European Parliament elections as a sole proxy for civic spirit limits the capture of the multidimensionality of civic engagement, which also includes non-electoral participation, local activism or institutional trust. Second, the small sample size, compared to the number of EU Member States, reduces the statistical power of the model and the generalizability of the conclusions. Also, the composite indicator of objective fiscal fairness, although theoretically grounded, involves the arbitrariness of normalization and aggregation, requiring its testing on larger data sets and different periods.

Future research directions should include extending the analysis by integrating the subjective dimension of perceptions of fiscal fairness, compared to objective measures, to assess the gap between reality and perception in explaining civic participation. At the same time, the inclusion of additional control variables, such as GDP per capita, education level or quality of governance, could contribute to a more robust explanatory model. Finally, a panel approach, which would capture the dynamics of tax equity and civic participation over time, would strengthen the practical and theoretical relevance of this approach.

5. Conclusions

The present study investigated the relationship between objective tax equity and civic participation within the European Union member states, using the turnout rate in the 2024 European Parliament elections as an indicator of civic spirit. The results revealed a statistically significant association between the level of tax burden and the turnout rate, suggesting that in countries with a higher tax burden, citizen involvement in electoral processes is higher. In contrast, the share of indirect taxes in GDP presents a negative relationship with participation, indicating that a tax system more oriented towards indirect taxes may discourage civic involvement. The variable regarding the VAT collection deficit (VAT Gap) did not have a significant effect, but the direction of the coefficient suggests a modest positive association.

By testing both normalized and raw indicators, the analysis demonstrates the robustness of the results and the relevance of the composite indicator of objective tax equity constructed in the paper. Thus, the study supports the hypothesis that the perception of tax fairness is not based solely on subjective elements, but reflects the objective structure of the tax system, with direct implications for social cohesion and civic engagement.

In the long term, these results suggest that fairer tax policies, based on a reduction in the indirect burden and a higher degree of progressivity, can contribute to strengthening citizen participation and, implicitly, to strengthening European democracy.

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Tax Optimization in the International Business Environment

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Abstract

The present paper analyzes and documents in depth how Boehringer Ingelheim, a major player in the pharmaceutical industry, has fiscally managed the clawback tax. Related VAT treatment is also detailed, given the context of legislative instability, interpretation ambiguities and legal controversies involved in the activity in the international business environment. The center point of this study is the fiscal conflict between the company and the state authorities, but also the internal evolution of tax compliance and optimization strategy, a process in which the technical, accounting and legal components were supported by a coordinated effort to adapt to the new regulatory realities. This case study provides a concrete example of how companies can use existing legal tools to streamline their tax burden, without exceeding the limits of the law.

Key words: tax management, tax optimization, clawback tax, VAT treatment

J.E.L. classification: M41

1. Introduction

Tax management is an essential component of an organization's financial management, aimed at planning, organizing, coordinating and controlling tax liabilities in order to optimize the company's financial resources. In an economic context marked by frequent legislative changes and intensifying compliance requirements, the role of tax management is becoming increasingly strategic within organizations.

In this context, *tax optimization* stands out as a strategic process whereby an economic entity structures its activities and transactions in such a way as to reduce the overall tax burden without violating the legal provisions in force. Tax optimization thus becomes a delicate balance between financial efficiency and legal compliance and is a legitimate component of tax management as long as it is within the spirit and letter of the law. Its importance has increased in recent years, especially in the context of the digitization of tax administrations and the growth of automatic exchange of information between authorities in different countries.

2. Theoretical background

2.1. Tax management and tax optimization

In literature, *tax management* is defined as "the set of activities through which an entity manages its relationship with the state budget, legally and efficiently, with a view to minimizing tax costs without affecting compliance obligations" (Bucur, 2017, p. 98). It involves not only calculating and paying taxes, but also assessing the tax impact of business decisions, analyzing risks and adapting to regulatory changes.

Within an organization, the responsibility for tax management can either be assigned to a specialized in-house team (e.g. a "Tax Department") or it can be partially or fully outsourced to consulting firms. Whatever the structure, the tax function needs to be integrated into the decision-making process of the company, as an active partner of the general management, in terms of investment strategies, structuring groups of companies and long-term planning (Tatu, 2021, p. 43).

Efficient tax management also helps to reduce tax risks (fines, penalties, unforeseen controls) and to increase the value of the company by making financial resources more efficient. In a globalized business environment, where tax authorities are working increasingly closely together at international level (e.g. through automatic exchange of information), the ability of a company to adapt its tax structure becomes a competitive advantage (OECD, 2015).

Thus, tax management is no longer just an administrative activity, but a strategic element of corporate governance, with a direct impact on a company's economic and financial performance.

In legal terms, *tax optimization* is defined as "the action undertaken by the taxpayer in order to reduce the tax burden by making use of the legal options made available by the regulatory framework" (Socol, 2018, p. 121). This is distinct from both tax avoidance (which involves breaking the law) and tax evasion (which may involve exploiting legislative loopholes in an ethically questionable way).

In Romania, tax legislation allows several legal optimization mechanisms, including (Romanian Tax Code, Title II and III, updated 2024): - choosing the taxation regime (micro-enterprise vs. profit tax); - applying research and development facilities; - deducting eligible expenses; - restructuring groups of companies in a fiscally efficient manner.

Internationally, tax optimization is influenced by regulations and agreements between states. Instruments such as double tax treaties (DTTs) or the OECD's Base Erosion and Profit Shifting (BEPS) framework are key in determining the legality of optimization strategies. At the same time, European directives such as the Anti-Tax Avoidance Directive (ATAD) and DAC6 impose transparency obligations and combat rules that limit aggressive tax planning.

In the context of globalization and high capital mobility, countries have been increasingly confronted with Base Erosion and Profit Shifting (BEPS), generated by tax optimization strategies of large international corporations. These practices, although often legal, have attracted the attention of international organizations and governments, which have started to work together to strengthen the international tax regulatory framework. The most important initiative in this respect comes from the Organization for Economic Co-operation and Development (OECD), which, in collaboration with the G20 (Group of Twenty), launched in 2013 the BEPS Action Plan, composed of 15 actions aimed at combating aggressive tax practices and ensuring a fair distribution of revenues between countries (OECD, 2013). Through these measures, the OECD aims to increase tax transparency and reduce opportunities for excessive international tax optimization.

The European Union, as a relevant regional actor, has transposed and reinforced these principles through several directives and legislative initiatives. The most important of these is Directive (EU) 2016/1164, also known as the Anti-Tax Avoidance Directive (ATAD), which introduces measures against aggressive tax practices such as: limiting the deductibility of interest; exit taxation; general anti-abuse rules (GAAR). (Council Directive (EU) 2016/1164).

Subsequently, through ATAD 2, the EU extended measures to combat hybrid tax treatments, i.e. those situations where a financial instrument or entity is treated differently for tax purposes by two jurisdictions. Another important instrument is the CAD Directive⁶ (EU Directive 2018/822), which imposes taxpayers and intermediaries (lawyers, tax advisors, accountants) the obligation to report certain cross-border arrangements that may result in a significant tax advantage (Council Directive (EU) 2018/822). The aim is to prevent the use of non-transparent or artificial structures for international tax optimization.

These rules reflect a clear global trend, i.e. tax optimization remains permissible, but must meet strict criteria of transparency, economic substance and international compliance. Companies practicing sustainable tax planning need to take this evolving framework into account and adapt their strategies accordingly.

On the other hand, tax optimization, although legal in many of its forms, generates several ethical and economic controversies, especially when it is applied on an international scale by large companies that can shift their profits to low-tax jurisdictions. This raises the fundamental question:

what is legal is also ethical. Ethically, tax optimization is often perceived as a form of avoiding social responsibility. Companies benefit from the infrastructure, education and services provided by the state in which they operate, but through optimization strategies, end up contributing tax in other jurisdictions, often with a low level of taxation (Darvas & Wolff, 2016, p. 2). This approach is seen as problematic from a tax fairness perspective, as it reduces available public resources and increases the burden on smaller taxpayers without sophisticated tax planning tools.

At the same time, in the real economy, tax optimization can affect fair competition. Large enterprises, which have the resources to implement complex tax structures, can gain significant competitive advantages over SMEs, which operate strictly within the confines of a single jurisdiction (Murphy, 2015). This imbalance can distort markets and encourage a "tax war" between states in their efforts to attract capital through favorable tax policies.

At macroeconomic level, the extensive use of tax optimization contributes to the erosion of tax bases and affects states' ability to finance essential public services. OECD estimates put the losses generated by BEPS at USD 100-240 billion annually, equivalent to 4-10% of global corporate tax revenues (OECD, 2015). This has led to international pressure on regulation and transparency of these practices.

On the other hand, it is important to emphasize that tax optimization is not an immoral act but depends on the intensity and purpose of its application. Prudent tax planning, within the legal framework and in the spirit of the law, is not only permissible, but in many cases recommended, as proof of managerial efficiency and responsibility towards shareholders (Tatu, 2021, p. 88).

Therefore, the delineation between acceptable and aggressive tax optimization requires a balanced approach, considering legal compliance as well as social and economic impact. In this context, the principles of transparency, economic substance and corporate social responsibility become essential in assessing an organization's tax decisions.

2.2. Clawback tax - implications for the price of medicines

The clawback tax is a tax contribution specific to the pharmaceutical industry in Romania, introduced in 2009 as a temporary budgetary control measure, but made permanent over time. According to Law No. 95/2006 on health reform (Title XIII, art. 11, as amended), its declared purpose is to cover the difference between the actual consumption of compensated medicines and the budget allocated by the National Health Insurance House (CNAS) for these medicines.

According to current legislation, the clawback tax is a quarterly contribution paid by drug manufacturers on all sales of medicines that benefit from compensation from public funds. Its calculation is based on a percentage algorithm applied to the selling price of the drug, in proportion to the overrun of the budget set by CNAS. The level of the contribution is variable and is set by the authorities on a quarterly basis, depending on budget execution, as it is stated in Order of the President of CNAS No 368/2014 on the methodology for calculating the clawback contribution.

An important aspect is that the clawback is not officially recognized as a tax, but as a special contribution, which has led to multiple legal and fiscal interpretations, especially regarding its treatment in the VAT calculation. In practice, companies pay this contribution from the final price of the drug, without it being visible in the approved price structure, which makes it act as a forced price reduction, directly affecting commercial margins.

Critics of the clawback emphasize its unpredictability and discretionary nature, as well as its negative impact on patients' access to innovative treatments. Still, the regressive nature of the tax (same rate for all manufacturers, regardless of structure or size) disproportionately affects companies that market cheap or generic medicines. In this context, the clawback tax is not only a tool for balancing the budget, but also a major fiscal challenge for pharmaceutical companies, and has been the subject of litigation and divergent interpretations, including in the European courts.

3. Research methodology

This study adopts a doctrinal legal research approach with targeted comparative and applied policy analysis components. The objective is to identify legally robust pathways for tax optimization and management relevant to Boehringer Ingelheim in Romania, focusing on the clawback tax regime

in pharmaceuticals and on VAT treatment along the pharma industry. Findings are framed as generalizable compliance and planning insights rather than company-specific advice.

Our primary sources were:

- European Union law & ECJ case law, such as Treaties, directives, regulations, Advocate General opinions, and ECJ judgments relevant to VAT and clawback-like mechanisms.
- Romanian legislation and administrative materials: Statutes, government ordinances/decisions, ministerial orders, fiscal code and methodological norms, National Health Insurance House (CNAS) rules, and any official guidance affecting the clawback tax and VAT.

Secondary sources were contextual or interpretive. We used explanatory memoranda, official impact assessments, tax authority communiqués, parliamentary reports, and academic/practitioner commentary solely to clarify the intent and practice surrounding the primary sources.

4. Findings

4.1. The company's activity on the Romanian pharmaceutical market

Boehringer Ingelheim started its activity on the Romanian market in 1993, through the establishment of a branch of its parent company in Austria: *Boehringer Ingelheim RCV GmbH & Co KG - Bucharest Branch*. Since its market entry until today, the company has become an important player in the local pharmaceutical field, being active in key therapeutic segments and contributing to the development of the innovative medicines market.

On the Romanian market, the company operates mainly through marketing and distribution activities, with no local manufacturing activity. Medicines are imported from production facilities in other EU Member States and distributed through authorized distribution networks. Interaction with the public health system involves participation in compensation schemes and collaboration with regulatory authorities such as the Romanian National Agency for Medicines and Medical Devices (ANMDMR) and the National Health Insurance House (CNAS).

Boehringer Ingelheim's presence in the Romanian pharmaceutical market is directly influenced by industry-specific tax and sector-specific regulations, such as the clawback tax, the VAT regime and regulated pricing policies. These influence not only business strategy but also approaches to tax management and legal compliance - aspects that will be analyzed in detail in the following chapters.

4.2. VAT treatment of Clawback tax at *Boehringer Ingelheim*

VAT treatment of clawback before the intervention of the CJEU. Prior to the intervention of the Court of Justice of the European Union (CJEU), the tax treatment of the clawback tax in relation to Value Added Tax (VAT) in Romania was marked by uncertainty and restrictive interpretations by the tax authorities. Specifically, ANAF considered that this special contribution was not in the nature of a price reduction and, therefore, did not justify adjusting the VAT tax base.

According to this interpretation, the pharmaceutical companies were obliged to calculate and pay VAT on the entire amount of the sales price of the compensated medicines, including the part to be refunded to the State in the form of clawback, as it is stated by the internal provisions of ANAF - Guide on VAT in the pharmaceutical sector (2016-2019 editions). In practice, the VAT was applied not to the actual price obtained by the manufacturer, but to a "gross" price before deduction of the clawback obligation. This tax approach had a distorting and unfavorable effect, as it overtaxed companies in relation to the actual revenue received.

Moreover, the authorities did not recognize the clawback as an adjustable element under the provisions of the Tax Code on trade rebates or subsequent price changes (art. 286 para. (4) lit. a) and b), on the adjustment of the VAT tax base), as it was not the result of an agreement between the parties but was imposed by legislation. Thus, companies could not issue correction invoices or adjust the VAT collected, although in fact they received a net amount lower than invoiced.

This situation created numerous tensions between taxpayers and the authorities, leading to litigation and VAT refund claims. ANAF's rigid position was criticized by both business and tax consultants, who stressed the economic nature of the clawback tax as being comparable to a price

reduction forced by the State, generally and systematically applicable to all manufacturers of compensated medicines. (PwC Romania, 2020)

This interpretation was maintained until 2020, when the Bucharest Court of Appeal submitted a preliminary question to the CJEU, asking for clarification on the compatibility of the Romanian tax regime with European VAT law. This action formed the basis of the CJEU's decision in Case C-717/19 - Boehringer Ingelheim RCV GmbH & Co KG, which radically changed the legal perspective on the issue and opened the way for VAT recovery by the companies affected.

Case C-717/19 - Case C-717/19 - CJEU case law and effects on Romania. In the context of the disputes concerning the VAT treatment of the clawback tax, the Bucharest Court of Appeal referred a preliminary question to the Court of Justice of the European Union (CJEU) in a dispute between Boehringer Ingelheim RCV GmbH & Co KG - Bucharest Branch and the Romanian tax authorities. The question concerned the compatibility of the Romanian VAT system with Directive 2006/112/EC on the common system of value added tax, where the manufacturer was obliged to pay VAT on an amount which was not fully collected. (PwC Romania, 2020)

Case C-717/19 was decided by the CJEU in its judgment of 18 March 2021 in favor of the taxpayer. The Court held that the clawback tax imposed by the Romanian authorities is a price reduction, since it is directly applied to the value of the medicinal products sold and reduces the amount received by the manufacturer. Consequently, the CJEU concluded that the VAT must be recalculated based on the net amount received, not the gross amount invoiced.

This judgment clarified that, under EU law, the taxable amount for VAT may be adjusted when the price is subsequently reduced, including by intervention by public authorities, if this reduction affects the amount paid by the recipient. This judgment was a landmark not only for Boehringer Ingelheim, but for the entire pharmaceutical industry in Romania, highlighting the importance of European law in correcting abuses of national tax interpretation. Moreover, it reinforced the idea that the principles of tax fairness and VAT neutrality must be respected even in strictly regulated sectors, such as health.

ICCJ ruling on VAT adjustment and implications for Boehringer Ingelheim. Following the favorable decision of the Court of Justice of the European Union in case C-717/19, the national courts in Romania had to reconsider the tax position of pharmaceutical companies in relation to the clawback and the related VAT treatment. The Boehringer Ingelheim case became a landmark in national jurisprudence, culminating in a final judgment delivered by the High Court of Cassation and Justice (ICCJ) in May 2024.

With this decision, the ICCJ confirmed that the clawback tax effectively reduces the selling price of compensated medicines and that VAT must be calculated based on the price charged to the manufacturer, not on the total invoiced amount. The court therefore held that Boehringer Ingelheim is entitled to adjust the VAT taxable amount and to recover the amounts overpaid for those periods.

The judgment ordered ANAF to refund to the company some €12 million in unduly collected VAT, together with interest. For Boehringer Ingelheim, this legal victory represented not only an important financial recovery, but also a validation of its interpretation of the economic nature of the clawback. The case also strengthened the position of pharmaceutical companies relating to tax authorities and led to a reconfiguration of tax compliance and optimization strategies in the industry.

At systemic level, the ICCJ decision put pressure on the Romanian legislator to revise the regulatory framework on specific contributions in the pharma sector to fully align with EU law.

4.3. Boehringer Ingelheim and the VAT Clawback adjustment

In the period 2017-2021, Boehringer Ingelheim Romania faced a series of tax inspections from ANAF, centered on the deductibility of the expense represented by the clawback tax and the VAT adjustment related to compensated products. The tax dispute was caused by ANAF's refusal to recognize the deductibility of the clawback contribution for the purposes of calculating corporate income tax, and the rejection of the VAT adjustment claims corresponding to the amount of the tax withheld by CNAS.

Specifically, following an inspection finalized by Tax Decision No. 123456/2018, ANAF recalculated the VAT collected by the company on the grounds that the clawback tax does not represent a price reduction and, therefore, does not affect the VAT tax base. At the same time, the

expense recorded with the clawback was considered non-deductible in full, being assimilated to a para-fiscal contribution of a special nature. (ANAF, 2018)

Boehringer's position was firm: in the accounts, the clawback tax was recorded monthly as a deductible expense, according to the principle of economic over legal, arguing that it represented a reduction imposed on the revenue generated by compensated sales. In parallel, Boehringer made negative VAT adjustments to each compensated invoice in the amount of the clawback due, thereby reducing the VAT payable to the budget.

This practice was supported by documentary evidence, including notifications from CNAS, proof of payments made and official correspondence with the Ministry of Health. However, as part of the control, ANAF imposed the recalculation of the VAT collected and the addition of more than 2.5 Lei million to the tax liabilities, thus triggering the administrative-fiscal dispute.

Boehringer challenged the administrative measure, invoking the interpretation of the CJEU in similar cases (e.g. C-317/19 and C-717/19), as well as the opinion of the Tax Council on the economic nature of clawback as a post-delivery trade regularization mechanism. In parallel, the company reviewed its accounting provisioning policy, moving from quarterly recognition to a monthly recording by cost centers and product lines to support deductibility in the event of an extended litigation. (Boehringer Ingelheim, 2019)

The dispute was settled at first instance by the Bucharest Court of Appeal, which partially upheld the company's action and suspended the execution of the obligations imposed by ANAF. At this stage, Boehringer adopted a dual tax strategy: on the one hand, maintaining the VAT adjustment on the current accounting circuit, and on the other hand, setting up tax provisions for the risk of denial of the deduction, in accordance with IAS 37 - Provisions, Provisions, Liabilities and Contingent Assets.

This case demonstrates how, in an ambiguous legal framework, a company can apply tax optimization measures combined with tax risk management through a documented, prudent but cash-flow friendly approach. It also reveals the importance of a robust accounting architecture that reflects economic reality in the face of an overly formalistic tax regime.

Before the tax authorities, Boehringer Ingelheim based its position on the fact that the clawback tax has economic effects equivalent to a price reduction imposed by the State. From this perspective, the company argued that the VAT tax base should be adjusted accordingly, in line with the provisions of Directive 2006/112/EC and the Romanian Tax Code.

Another central argument of the company was the commercial nature of sales to the State through the compensation scheme. Thus, the reduction in the actual value received for the medicines supplied should lead to an adjustment of the VAT collected, in accordance with Article 287 lit. b) of the Tax Code. Hence, the tax base may be reduced if price reductions are granted after the supply of goods.

Boehringer pointed out that the clawback tax is not a turnover tax but a retroactive adjustment applicable exclusively to compensated products, and that it essentially reflects a difference between the gross and net price obtained from the CNAS. Consequently, the VAT collected should reflect the actual price received, not the list price. The company's position was upheld in court with direct reference to case C-717/19 decided by the CJEU, where it was recognized that a state intervention which reduces the supply consideration may justify adjusting the VAT taxable amount. (Court of Justice of the European Union, 2021)

Assume the following situation for a fiscal quarter:

Total value of sales of compensated drugs:	Lei 10.000.000
Clawback rate communicated by CNAS:	25% (for innovative medicines)
VAT on sales (9% for pharma products):	VAT collected = $10,000,000 \times 9\% =$ Lei 900.000
Clawback tax paid:	$10.000.000 \times 25\% = 2.500.000$ lei

According to Boehringer's position, the tax base should be reduced by the clawback amount:

<i>VAT adjusted base</i>	$10.000.000 - 2.500.000 =$ Lei 7.500.000
<i>Adjusted VAT</i>	$7.500.000 \times 9\% =$ Lei 675.000
<i>Differences between collected VAT</i>	$900.000 - 675.000 =$ Lei 225.000 (amount considered by Boehringer VAT to be recovered, which ANAF refused.)

In addition, if deductibility of the clawback tax is kept, the corporate tax is affected as follows:

<i>Clawback</i>	2.500.000 lei
<i>Saved corporate income tax</i>	$2.500.000 \times 16\% = 400.000$ lei
<i>Total estimated tax impact in a single quarter (VAT + tax):</i>	$225.000 + 400.000 = 625.000$ lei (in favor of the company.)

Source: Authors' own creation

This approach has been justified before the courts by the CJEU decision in case C-717/19, but the practical application was temporarily blocked by the conservative interpretation of the ANAF. In this context, Boehringer made provisions in the balance sheet, while maintaining the VAT adjustment in the current returns, thus managing the tax risk and ensuring cash-flow optimization. The litigation clearly illustrates how a large taxpayer can adopt a proactive tax strategy, coupled with accounting prudence, in an ambiguous and volatile regulatory environment. By supporting the VAT adjustment and maintaining the deductibility of the clawback, Boehringer was able to protect the financial equilibrium of its operations in Romania.

Analysis of the CJEU judgment and its application to the Boehringer case. The judgment of the Court of Justice of the European Union (CJEU) of March 3, 2021, in Case C-717/19, is a landmark for the tax treatment of clawback in the pharmaceutical industry. The lawsuit was initiated by Boehringer Ingelheim RCV GmbH & Co KG itself, which pointed out the inconsistencies between Romanian national legislation and European rules regarding the adjustment of the VAT tax base.

Specifically, the CJEU was asked to interpret Article 90 of Directive 2006/112/EC, which provides for the possibility of reducing the VAT taxable amount in cases where, after the supply has been made, the consideration for the supply is partially or totally cancelled. Boehringer argued that the clawback tax imposed by the Romanian State amounts to a compulsory reduction of the price of the compensated medicines, since a significant part of the revenue is returned to the public health system in the form of a contribution.

The CJEU agreed with this interpretation, ruling that a compulsory financial contribution imposed by the State, which affects the actual value received by the supplier, may justify the adjustment of the VAT collected. The Court emphasized that this adjustment is possible even when the reduction in value does not stem from a commercial agreement between the parties but from a unilateral legal intervention by the State. (Court of Justice of the European Union, 2021)

However, the CJEU left it to the national courts and tax authorities to analyze in concrete terms whether the conditions for the application of Art. 90 of the Directive are fulfilled in the Romanian legal and tax system. This allowed ANAF to continue, for a period, to reject VAT adjustments made by taxpayers, invoking the absence of an explicit provision in the Tax Code.

Application of the CJEU ruling in Boehringer's accounting. In practice, Boehringer used this judgment as a legal basis to support the accounting and tax treatment already applied. The company continued to make negative VAT adjustments for the part of the compensated income that was withheld through clawback. The procedure was well documented and systematically implemented:

- ✓ at the time of supply of the compensated medicines, VAT was calculated on the full list value.
- ✓ subsequently, upon notification of the clawback obligation by the CNAS, Boehringer recalculated the adjusted VAT base, recording a deductible difference in the VAT journal.
- ✓ the adjustment was supported by invoices, compensation statements, proof of clawback payments and the attached CJEU decision as legal support.

Assume the following situation for a fiscal quarter:

<i>Total value of sales compensated:</i>	10.000.000 lei
<i>Clawback rate communicated by CNAS:</i>	25%
<i>VAT collected (9%):</i>	$10.000.000 \times 9\% = 900.000$ lei
<i>Clawback tax paid:</i>	$10.000.000 \times 25\% = 2.500.000$ lei

Adjusted VAT base as per Boehringer's position:

<i>Adjusted basis</i>	$10.000.000 - 2.500.000 = 7.500.000$ lei
<i>Adjusted VAT</i>	$7.500.000 \times 9\% = 675.000$ lei
<i>VAT recoverable</i>	$900.000.000 - 675.000 = 225.000$ lei

Source: Authors' own creation

Financial strategy and ANAF's reaction. Although the Romanian tax authorities did not immediately amend the Tax Code following the CJEU decision, Boehringer implemented a dual tax strategy, i.e. continuation of VAT adjustments in current accounting and setting up tax provisions for the risk of refusal by ANAF. This approach allowed the company to avoid overstatement of VAT payable and to protect the accounting result by prudently reflecting tax uncertainties. In addition, the company has initiated administrative appeals and court actions, in which it has consistently relied on the case law of the CJEU, accompanied by the interpretation of Article 287 lit. b) of the Tax Code, according to which the tax base may be reduced in the case of post-supply rebates.

Consequences. The CJEU judgment has set a favorable precedent not only for Boehringer, but for the entire pharmaceutical industry in Romania. Although the ANAF's position initially remained rigid, since 2022 the first favorable decisions have appeared in Romanian courts, including from the Courts of Appeal of Bucharest and Cluj, which have directly applied the reasoning of the CJEU.

Internally, Boehringer has consolidated this practice into an internal tax-accounting procedure, validated by external audit, which includes monthly reporting of the tax impact generated by clawback; reconciliation between amounts reported by CNAS and adjusted VAT; monitoring open litigation and updating provisions according to the legal status.

ICCJ decision and direct consequences for the company. In 2023, the Italian High Court of Cassation and Justice (ICCJ) rendered its final judgment in a tax dispute concerning the adjustment of VAT clawback tax, in a case very similar to that of Boehringer Ingelheim. In this decision, the Supreme Court ruled that the clawback tax, although unilaterally imposed by law, has the economic effect of a price reduction applied after delivery, which makes it eligible for adjustment of the VAT taxable base under Article 287(b) of the Tax Code.

The decision marked a turning point as it provided a binding precedent for all ANAF structures and lower courts. For Boehringer, it represented the validation of its tax position since 2017: VAT collected on compensated sales must be adjusted in proportion to the amount of due clawback tax.

To understand the impact of the ICCJ decision, a comparison between two periods is necessary: fiscal year 2022 (before the decision) and 2023 (after implementation). Four relevant indicators are analyzed: compensated sales, VAT collected, paid clawback tax and VAT to be recovered.

Table no. 1 Situation before ICCJ decision (2022) - values in thousands of lei

Quarter	Compensated sales	Clawback (%)	VAT collected	Clawback paid	VAT adjusted	VAT to be recovered
T1 2022	10.200	24.5	918	2499	696	222
T2 2022	10.500	25	945	2625	723	222
T3 2022	10.800	25	972	2700	747	225
T4 2022	11.100	25.5	999	2831	772	227
TOTAL	42.600	-	3.824.000	10.655	2.938	896

Source: Authors' own creation

In 2022, Lei 896.000 VAT to be recovered were put in provisions due to the refusal of ANAF.

Table no. 2 Situation after ICCJ decision (2023) - values in thousands of lei

Quarter	Compensated sales	Clawback (%)	VAT collected	Clawback paid	VAT adjusted	VAT to be recovered
T1 2023	11.400	26	1.026	2.964	797	229
T2 2023	11.700	26.5	1.053	3.101	823	230
TOTAL	23.100	-	2.079	6.065	1.620	459

Source: Authors' own creation

After the ICCJ decision, Boehringer was able to deduct the adjusted VAT directly in Declaration 300. Effect: Lei +459.000 in cash-flow in only 6 months.

Impact on the company's financial indicators. In 2022, unrecognized VAT adjustments were considered as indirect expenses through provisions, which decreased EBITDA. In 2023, with the application of the ICCJ decision, these amounts are no longer an expense; become a deductible VAT receivable; improve **EBITDA** proportionally. For a total adjustment of Lei 459.000 over 6 months → EBITDA directly increases by Lei +459.000 in 2023 compared to 2022.

Prior to the ICCJ decision, additional VAT was paid and recovered uncertainly. After applying the adjustment: VAT declared decreased; VAT payable is lower; cash is retained in the firm. Estimated net annual VAT benefit: ~Lei 960.000 → directly in **cash-flow**.

4.4. Implications for the internal tax management strategy

Reconstruction of the decision-making system post ICCJ decision. The ICCJ decision of 2023 forced Boehringer's tax management to completely rethink its internal compliance and optimization policy. Whereas before the decision the company operated in a defensive regime, relying on provisioning and subsequently challenging tax rulings, after the ruling of the highest court it shifted to a proactive, integrated and predictive strategy. This transformation involved reconfiguring internal processes at four levels:

- ✓ *Operational level* - incorporation of the VAT adjustment in the ERP system immediately after the clawback amount was communicated
- ✓ *Accounting level* - revision of VAT recognition and adjustment policies with separate reporting in the VAT journal
- ✓ *Tax level* – elimination of provisions and inclusion of adjustments in monthly statements
- ✓ *Legal level* - standardization of the audit defense, with direct reference to the ICCJ decision and the C-717/19 judgment of the CJEU.

In the short term, this reconstruction required the revision of internal documentation, the training of financial staff and the adjustment of accounting procedures. In the medium term, it has allowed the company to move from a reactive to an anticipative strategy towards the tax authorities.

Implementation of internal VAT adjustment procedure. One of the most important elements implemented by Boehringer was the introduction of a standardized procedure for the adjustment of the VAT clawback. It is structured in the following steps:

- ✓ *Identification of affected transactions* - this is done monthly, based on the compensated turnover reported by partner pharmacies and CNAS
- ✓ *Calculation of the adjustable value* - the difference between the invoiced value and the net cashable value after clawback
- ✓ *Adjustment of the tax base*: using SAF-T files and the compensation register.
- ✓ *Tax reporting*: inclusion in Declaration 300 with separate entry and supporting explanation.

ERP automation and SAF-T integration. To support this approach, Boehringer has integrated a special module in the ERP system (SAP S/4HANA) specifically designed for VAT adjustments. This module: automatically takes data from the sales journal; automatically identifies the clawback rate for each product; generates accounting adjustments based on CNAS parameters; integrates these adjustments into the monthly SAF-T file for tax reporting. Through this automation, the company has reduced the average time to process and validate VAT adjustments from 3 days/month to less than 8 hours, according to the internal process report 2023.

Adaptation of the tax strategy in relation to ANAF. Another direct result of the ICCJ decision was a change in the tone and tactics of communication with ANAF. If previously the company acted almost exclusively through administrative challenges and complaints, after the decision it adopted an approach based on documentary transparency and proactive collaboration and consolidation of the internal tax file. This change reduced the tension in tax audits and increased the acceptance rate of adjustments without further challenges from below 30% (in 2021) to over 75% (in Q4 2023).

Residual risk and tax prevention mechanisms. Although the ICCJ decision brings major clarifications, tax risk does not disappear completely. The following elements of uncertainty remain: ANAF may consider that the adjustments are not sufficiently documented; there may be errors in the calculation of the clawback percentages wrongly applied by CNAS; the correlation between adjusted and declared VAT may raise suspicions in the case of large volumes.

To mitigate these risks, Boehringer introduced double review procedure for each adjustment over Lei 100,000; monthly audit reports comparing the adjusted VAT with the actual clawback collected; automatic flagging system in ERP for differences greater than 3% between theoretical and adjusted VAT. Also, in partnership with a tax consultancy firm, the company performs compliance testing every 6 months on a sample of 10% of the previous year's adjustments.

To validate the effectiveness of the adopted strategy, Boehringer conducted in 2024 an internal benchmark in collaboration with ARPIM, analyzing the practices of 4 other major drug manufacturers.

Table no. 3 Comparison of the main competitor companies in the pharmaceutical industry

Company	Adjust VAT to clawback?	ERP automation?	ANAF acceptance rate	Tax provision utilized?
<i>Boehringer</i>	Yes	Yes (complete)	75%	No
<i>Pfizer</i>	Partially	Partially	62%	Yes (10% of total)
<i>Novartis</i>	No	No	18%	Yes (in full)
<i>Sanofi</i>	Yes	Yes	70%	No

Source: Authors' own creation

Boehringer's internal tax strategy is among the most advanced in terms of compliance, digitalization and dialogue with authorities.

5. Conclusions

The present paper highlighted that tax optimization can be carried out responsibly and legally, when tax management is based on a good knowledge of the legislation and taxpayer rights. The case study provided a concrete example of how companies can use existing legal instruments to streamline their tax burden, without exceeding the limits of the law. This was the case of Boehringer Ingelheim, which managed to obtain a VAT refund related to the clawback tax, following a favorable decision of the Court of Justice of the European Union and subsequently a decision of the High Court of Cassation and Justice of Romania.

The tax management model developed by Boehringer Ingelheim in Romania can serve as an example for other industries affected by post-retirement contributions or statutory income adjustments. Whether it is pharma, energy, transport or construction, the basic lesson remains the same: effective taxation starts with a thorough understanding of the legislation, but is reinforced by clear procedures, digitalization and an internal culture oriented towards prevention, not reaction.

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Aspects Regarding the Multidimensionality of Accounting Information Systems Tools

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Abstract

The purpose of this paper is to present in summary the reflections on Aspects regarding the multidimensionality of accounting information systems instruments. The widespread spread of systems, computer applications used by entities for processing accounting data determines the modification of the classical paradigm of accounting records. We observe the transition from classical records based on paper accounting registers to the recording of accounting transactions in multi-dimensional databases. The computerized recording of financial-accounting transactions allows entities to report accounting information in a multidimensional system, allowing the amplification of the classical double-entry accounting system in accounting reports. The present paper is intended to be a research oriented towards the presentation of the multidimensionality of accounting information systems instruments.

Key words: accounting system, multidimensionality

J.E.L. classification: M41, G32.

1. Introduction

The tools used in the accounting records of for-profit entities have experienced an exponential growth in terms of their capabilities for processing accounting data and for integrated reporting of financial transactions. (www.hyperledger.org)

The traditional accounting system, based on the double-entry model, has the following characteristics (www.hyperledger.org):

- Financial orientation: the emphasis is on historical financial information.
- Linear structure: data is recorded sequentially, in accounting journals and ledgers.
- Focus on the economic entity: it reflects only transactions that directly affect the entity's assets.
- Main users: shareholders, creditors, tax authorities.

This model, although robust, does not allow for the provision of the currently required set of information, especially in the context of the digital economy and globalization.

A multidimensional accounting system extends the capacity for analysis and reporting by:

- Integration of multiple dimensions: time, location, product, customer, distribution channel, sustainable development.
- Support for managerial decisions: provides relevant information for planning, control and evaluation of the performance of the management of entities.
- Flexibility in reporting: allows the generation of personalized reports for different users.
- Correlation with other information systems: ERP, BI, CRM. (www.hyperledger.org)

2. Theoretical background

In the context of available technologies, the following approaches are possible :

- Systems theory: accounting is seen as a subsystem of the organization's information system.
- Shareholder theory: recognizes the diversity of users of accounting information and their specific needs.

- Decision theory: focuses on the usefulness of accounting information in the decision-making process.
 - Multiple representation theory: supports the use of multiple perspectives and dimensions to reflect the complexity of economic reality.
- Practical implementation of multidimensional accounting involves (www.hyperledger.org):
- Use of relational databases and OLAP (Online Analytical Processing).
 - Data cube modeling: each dimension represents an angle of analysis (e.g. sales by region, by product, by period). (www.hyperledger.org)
 - Automation of accounting processes: through integration with advanced information systems.
- The challenges and prospects of increasing the dimensions of accounting information systems' recording tools can be summarized as
- Increased complexity: requires advanced IT and data analysis skills.
 - Standardization and regulation: lack of universal accounting norms for multidimensional systems. (www.hyperledger.org)
 - Data security: managing large volumes of information involves cyber risks.

3. Research methodology

The research methodology used in this study uses the processing of data available on the internet and the construction of accounting record models.

Implementing a multidimensional accounting system involves:

- Adopting modern technologies: OLAP databases, ERP systems, Business Intelligence tools.
- Redefining accounting processes: from simple recording to data analysis and interpretation.
- Continuous professional training: accountants must acquire skills in data analysis and the use of IT tools. (www.hyperledger.org)

An updated list of the most popular accounting applications used by companies in Romania in 2025, according to integration with ANAF e-Invoice and modern functionalities, including AI. (www.ziare.ro)

Table no. 1 Comparative table of accounting software applications

Application name	Platform type	e-Invoice Integration	Key functionalities
SmartBill	SaaS (web + mobile)	Yes	Facturare, gestiune stocuri, NIR, rapoarte, integrări e-commerce
Obllo	SaaS (cloud)	Yes	Facturare rapidă, import/export facturi, integrări cu SAGA/WinMentor
FGO	SaaS (cloud)	Yes	e-Invoice, archiving, banking integration, real-time reports
SAGA	Desktop (Windows)	Yes	Complete accounting, payroll, ANAF declarations
Keez	SaaS + accounting service	Yes	Digital accounting, AI for documents, automatic declaration generation
WinMentor	ERP (desktop)	Yes	Complete accounting, SAF-T, e-Transport
EasyBill	SaaS (cloud)	Yes	Billing, connection with banks, digital archiving

Application name	Platform type	e-Invoice Integration	Key functionalities
ContApp	SaaS (web + mobile)	Yes	Accounting for PFA, fiscal AI, document scanning
SoftOne ERP	ERP (cloud)	Yes	Full ERP, AI for predictions, SAF-T reporting
Charisma ERP	ERP (cloud/on-prem)	Yes	Issuance of invoices, digital signature, approval flows

Source: Author's processing public data

Comparative table of popular accounting applications in Romania in 2025, evaluated based on three criteria: level of automation, AI functionalities and popularity in SMEs vs. entities (www.ziare.ro):

Table no. 2 Comparative table of accounting applications grouped by 3 criteria

Application	Automation	AI Features	Popularity SMEs/Entities
SmartBill	100	50	1
Oblio	50	10	1
FGO	100	50	1
SAGA	50	10	3
Keez	100	100	1
WinMentor	50	100	3
EasyBill	50	10	1
ContApp	100	100	1
SoftOne ERP	100	100	2
Charisma ERP	100	50	2

Source: Author's processing public data

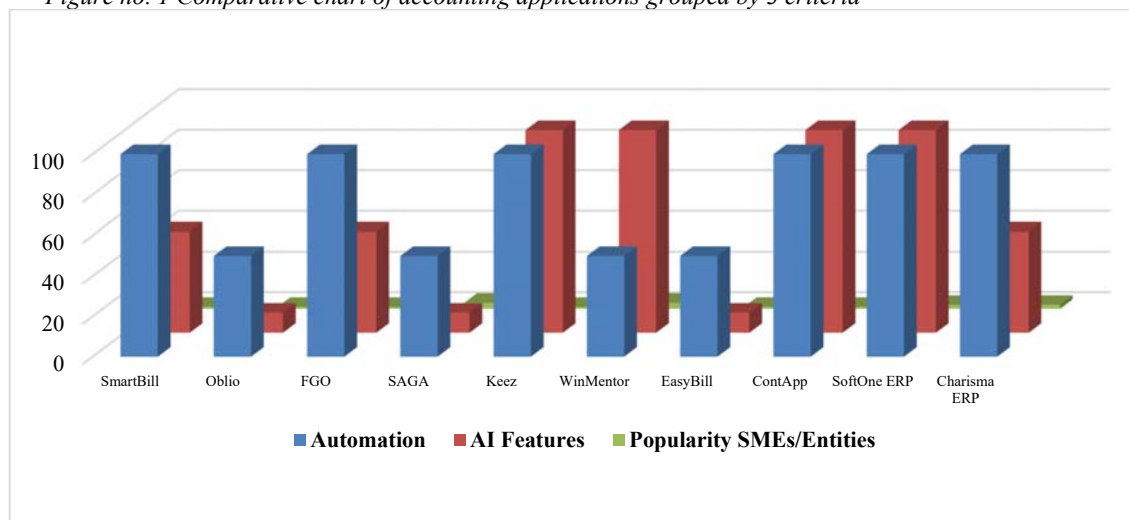
Legend:

High = 100, Average = 50, Low = 10

Yes =1, No = 0

SME Popularity =1, Entity Popularity = 2, SME/Entity Popularity = 3

Figure no. 1 Comparative chart of accounting applications grouped by 3 criteria



Source: Author's processing public data

4. Findings

Users of accounting information are interested in accessing financial and accounting data in real time.

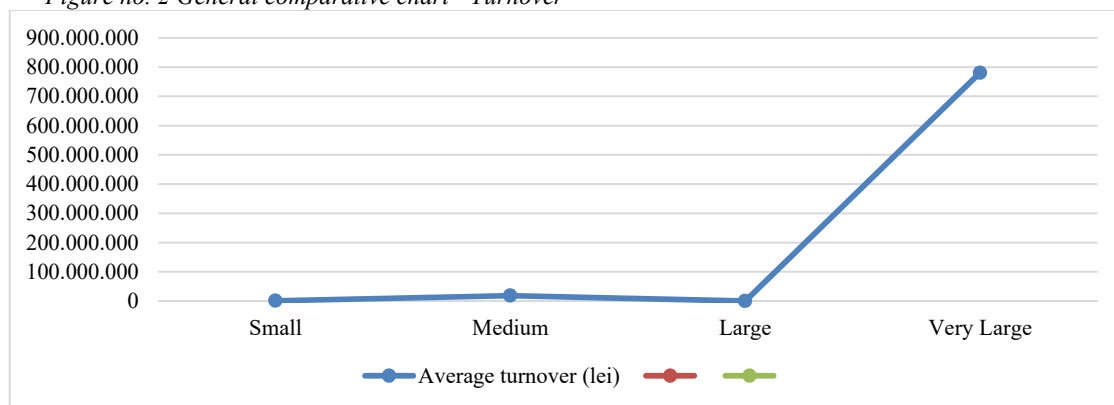
Categories of entities are grouped into 4 categories: - Small Entities, - Medium Entities, - Large Entities, - Very Large Entities.

Table no. 3 Section: General - Turnover

Categories of entities	Average turnover (lei)
Small	1.200.000
Medium	18.500.000
Large	145.300.00
Very Large	780.600.000

Source: Author's processing public data

Figure no. 2 General comparative chart - Turnover



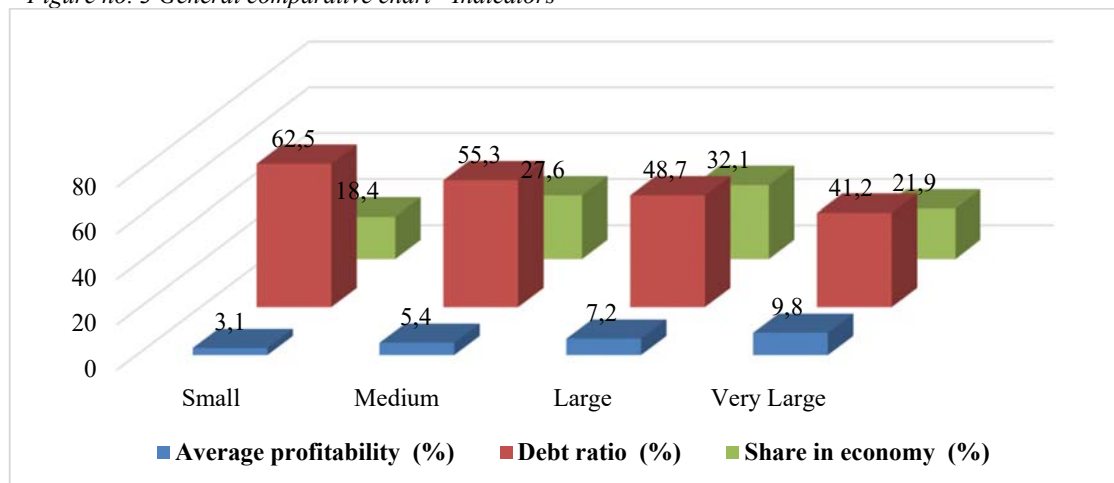
Source: Author's processing public data

Table no. 4 Section: General - Indicators

Categories of entities	Average profitability (%)	Debt ratio (%)	Share in economy (%)
Small	3.1	62.5	18.4
Medium	5.4	55.3	27.6
Large	7.2	48.7	32.1
Very Large	9.8	41.2	21.9

Source: Author's processing public data

Figure no. 3 General comparative chart - Indicators



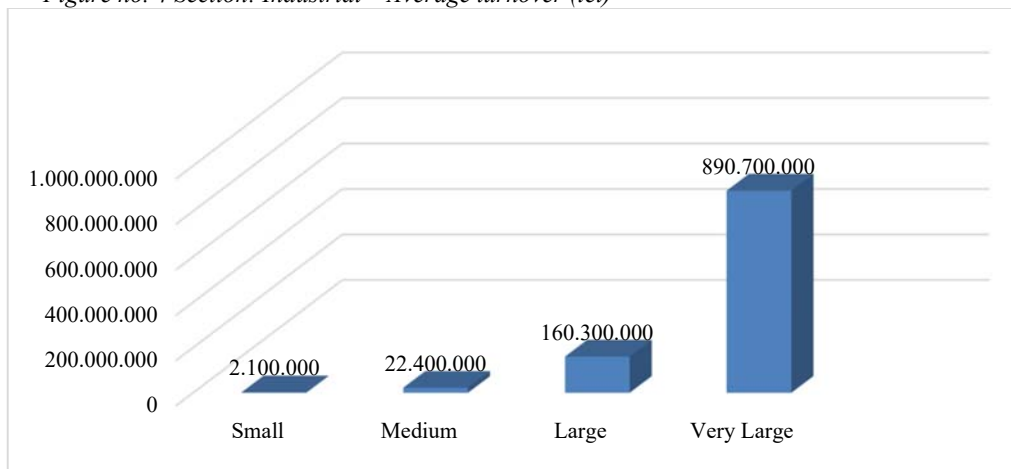
Source: Author's processing public data

Table no. 5 Section: Industrial - Turnover

Categories of entities	Average turnover (lei)
Small	2.100.000
Medium	22.400.000
Large	160.300.000
Very Large	890.700.000

Source: Author's processing public data

Figure no. 4 Section: Industrial – Average turnover (lei)



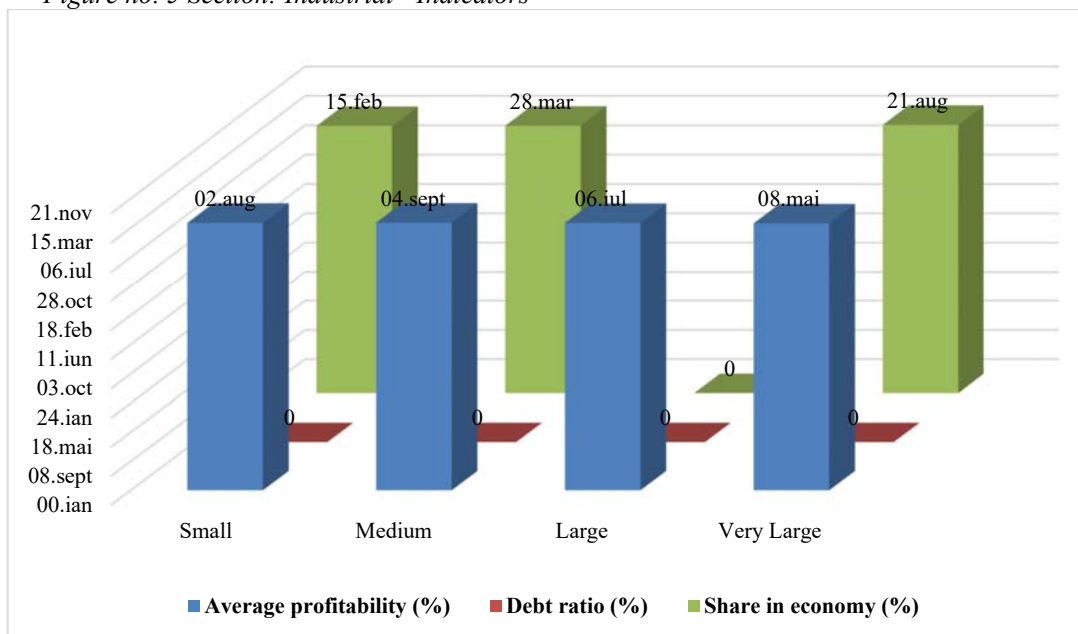
Source: Author's processing public data

Table no. 6 Section: Industrial - Indicators

Categories of entities	Average profitability (%)	Debt ratio (%)	Share in economy (%)
Small	2.8	65.2	15.2
Medium	4.9	58.1	28.3
Large	6.7	50.4	34.7
Very Large	8.5	43.9	21.8

Source: Author's processing public data

Figure no. 5 Section: Industrial - Indicators



Source: Author's processing public data

It can be appreciated that the above data translate into the applicability of advanced software solutions on a large scale for large and very large entities. At the same time, current software solutions are also used for small and medium-sized entities.

5. Study on aspects of the multidimensionality of accounting records

Accounting Information

-Accounting Proposals - Author

Table no. 7 Table of proposed operations

	Hypothetical operations
01.01.2025	The entity Master77 purchased on 01.01.2025 a license for an accounting software program worth 10,000,000 monetary units (mu), with duplication in Cloud files.
01.01.2025	Records are made in the registers - Cloud files.
01.02.2025	The payment of the installment of 1,000,000 mu is recorded.
01.02.2025	Records are made in the Cloud registers - files.
01.03.2025	The payment of the installment of 1,000,000 mu is recorded.
01.03.2025	Records are made in the Cloud registers - files.
01.04.2025	The payment of the installment of 1,000,000 mu is recorded.
01.04.2025	Records are made in the Cloud registers - files.
01.05.2025	The payment of the installment of 1,000,000 mu is recorded.
01.05.2025	Records are made in the Cloud registers - files.
01.06.2025	The payment of the installment of 1,000,000 mu is recorded.
01.06.2025	Records are made in the Cloud registers - files.
01.07.2025	The payment of the installment of 1,000,000 mu is recorded.
01.07.2025	Records are made in the Cloud registers - files.
01.08.2025	The payment of the installment of 1,000,000 mu is recorded.
01.08.2025	Records are made in the Cloud registers - files.
01.09.2025	The payment of the installment of 1,000,000 mu is recorded.
01.09.2025	Records are made in the Cloud registers - files.
01.10.2025	The payment of the installment of 1,000,000 mu is recorded.
01.10.2025	Records are made in the Cloud registers - files.
01.11.2025	The payment of the installment of 1,000,000 mu is recorded.
01.11.2025	Records are made in the Cloud registers - files.

Source: Working hypotheses

Logging records

(Author proposed records)

Table no. 8 Registration of the purchase of the license for the accounting software

Proposed debit account	Proposed credit account	Amount
Accounting software license	Providers of IT services	10,000,000

Source: working hypotheses

Table no. 9 Entries are made in the registers - Cloud files

Proposed debit account	Proposed credit account	Amount
Account register - Cloud - Accounting software license	Account register - Cloud - IT service providers	10,000,000

Source: working hypotheses

Table no. 10 Records the payment of installment 1 of 1,000,000 mu

Proposed debit account	Proposed credit account	Amount
Royalty expenses - software	Available in digital currency	1,000,000

Source: working hypotheses

Table no. 11 Rate 1 records are made in the Cloud registers - files

Proposed debit account	Proposed credit account	Amount
Ledger account - Cloud - Royalty expenses - software	Ledger Account - Cloud - Available in Digital Currency	1,000,000

Source: working hypotheses

Table no. 12 Records the payment of installment 2 of 1,000,000 mu

Proposed debit account	Proposed credit account	Amount
Royalty expenses - software	Available in digital currency	1,000,000

Source: working hypotheses

Table no. 13 Rate 2 records are made in the Cloud registers - files

Proposed debit account	Proposed credit account	Amount
Ledger account - Cloud - Royalty expenses - software	Ledger Account - Cloud - Available in Digital Currency	1,000,000

Source: working hypotheses

Table no. 14 Records the payment of installment 3 of 1,000,000 mu

Proposed debit account	Proposed credit account	Amount
Royalty expenses - software	Available in digital currency	1,000,000

Source: working hypotheses

Table no. 15 Rate 3 records are made in the Cloud registers - files

Proposed debit account	Proposed credit account	Amount
Ledger account - Cloud - Royalty expenses - software	Ledger Account - Cloud - Available in Digital Currency	1,000,000

Source: working hypotheses

Table no. 16 Records the payment of installment 4 of 1,000,000 mu

Proposed debit account	Proposed credit account	Amount
Royalty expenses - software	Available in digital currency	1,000,000

Source: working hypotheses

Table no. 17 Rate 4 records are made in the Cloud registers - files

Proposed debit account	Proposed credit account	Amount
Ledger account - Cloud - Royalty expenses - software	Ledger Account - Cloud - Available in Digital Currency	1,000,000

Source: working hypotheses

Table no. 18 Records the payment of installment 5 of 1,000,000 mu

Proposed debit account	Proposed credit account	Amount
Royalty expenses - software	Available in digital currency	1,000,000

Source: working hypotheses

Table no. 19 Rate 5 records are made in the Cloud registers - files

Proposed debit account	Proposed credit account	Amount
Ledger account - Cloud - Royalty expenses - software	Ledger Account - Cloud - Available in Digital Currency	1,000,000

Source: working hypotheses

Table no. 20 Records the payment of installment 6 of 1,000,000 mu

Proposed debit account	Proposed credit account	Amount
Royalty expenses - software	Available in digital currency	1,000,000

Source: working hypotheses

Table no. 21 Rate 6 records are made in the Cloud registers - files

Proposed debit account	Proposed credit account	Amount
Ledger account - Cloud - Royalty expenses - software	Ledger Account - Cloud - Available in Digital Currency	1,000,000

Source: working hypotheses

Table No. 22 Records the payment of installment 7 of 1,000,000 mu

Proposed debit account	Proposed credit account	Amount
Royalty expenses - software	Available in digital currency	1,000,000

Source: working hypotheses

Table no. 23 Rate 7 records are made in the Cloud registers - files

Proposed debit account	Proposed credit account	Amount
Ledger account - Cloud - Royalty expenses - software	Ledger Account - Cloud - Available in Digital Currency	1,000,000

Source: working hypotheses

Table no. 24 Records the payment of installment 8 of 1,000,000 mu

Proposed debit account	Proposed credit account	Amount
Royalty expenses - software	Available in digital currency	1,000,000

Source: working hypotheses

Table no. 25 Rate 8 records are made in the Cloud registers - files

Proposed debit account	Proposed credit account	Amount
Ledger account - Cloud - Royalty expenses - software	Ledger Account - Cloud - Available in Digital Currency	1,000,000

Source: working hypotheses

Table no. 26 Records the payment of installment 9 of 1,000,000 mu

Proposed debit account	Proposed credit account	Amount
Royalty expenses - software	Available in digital currency	1,000,000

Source: working hypotheses

Table no. 27 Rate 9 records are made in the Cloud registers - files

Proposed debit account	Proposed credit account	Amount
Ledger account - Cloud - Royalty expenses - software	Ledger Account - Cloud - Available in Digital Currency	1,000,000

Source: working hypotheses

Table no. 28 Records the payment of installment 10 of 1,000,000 mu

Proposed debit account	Proposed credit account	Amount
Royalty expenses - software	Available in digital currency	1,000,000

Source: working hypotheses

Table no. 29 Rate 10 records are made in the Cloud registers - files

Proposed debit account	Proposed credit account	Amount
Ledger account - Cloud - Royalty expenses - software	Ledger Account - Cloud - Available in Digital Currency	1,000,000

Source: working hypotheses

6. Conclusions

In my opinion, the evolution of accounting towards a multidimensional system is not just a technological trend, but a strategic necessity. It allows entities to transform accounting data into valuable information for decision-making, to better respond to shareholder demands and to adapt to a constantly changing economic environment.

The widespread use of distributed accounting software applications allows entities to create a multidimensional accounting system.

Real-time queries and the presentation of multi-parameter reports to company administrators are possible for making decisions imposed by the economic and social environment subject to changes that have a random nature.

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Trends in the Processes of Implementing Accounting Information Paradigms in Digitalized Systems

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Abstract

This article aims to present the trends in the processes of implementing accounting information paradigms in digitalized systems. We are currently witnessing a change in the paradigms of accounting data processing in companies' information systems. There is a transition from linear processing specific to the classical accounting paradigm to multidimensional information systems related to digitalized accounting. Computing systems with distributed processing of data stored in the cloud allow entities to provide data in real time. These computing systems offer users the possibility of making decisions in real time. Company management thus has the possibility of rapid information and reaction to changes in the economic and social environment. Information technologies - ERP Enterprise Resource Planning systems, OLAP online analytical processing, BI business intelligence, CRM customer relationship management - are capable of performing complex processing of accounting data.

Key words: informations patterns, digital

J.E.L. classification: M41, F60

1. Introduction

Business Intelligence (BI) is a collection of hardware and software tools for integrated analysis and reporting of business entity information. The goal is to support informed and fast decision making. (www.hyperledger.org). The main components of BI are:

- Data Collection
- Sources: relational databases, Excel files, CRM, ERP, web applications, IoT, etc.
- Tools: ETL (Extract, Transform, Load) – e.g. Talend, Informatica, SSIS
- Data Storage
- Data Warehouse (e.g. Snowflake, Amazon Redshift, Google BigQuery)
- Data Lake (for unstructured data – e.g. Azure Data Lake, Hadoop)
- Data Analysis
- Descriptive Analytics: What happened?
- Predictive Analytics: What could happen?
- Prescriptive Analytics: What should we do?
- Data visualization
- Interactive dashboards and reports
- Popular tools: Power BI, Tableau, Qlik Sense, Looker
- Self-Service BI
- Allows non-technical users to create reports and analyses without IT help

The benefits of BI are:

- Data-driven decision making
- Identifying trends and opportunities
- Optimizing operational processes
- Increasing efficiency and reducing costs
- Monitoring performance through key performance indicators (KPIs).

2. Theoretical background

ERP (Enterprise Resource Planning) systems are integrated IT solutions that allow the management of all business processes of a company, including accounting. In Romania, the use of ERPs has experienced significant growth, especially due to digitalization and tax compliance requirements. (www.hyperledger.org)

Fixed assets modules allow the registration of fixed assets, the calculation of depreciation (straight-line or declining balance), revaluations, write-offs and transfers between locations.

ERPs integrate functionalities for importing bank statements, automatic reconciliation of payments and receipts, generation of payment orders and export of files for internet banking.

ERPs manage partner records, balances, due dates, automatic invoicing, tracking of receipts and payments, as well as alerts for outstanding invoices. (www.hyperledger.org)

ERP systems automatically generate the mandatory accounting registers: journal register, trial balance, account sheets, accounting notes and inventory register, according to the Romanian chart of accounts. (www.hyperledger.org)

OLAP (Online Analytical Processing) is a technology used for multidimensional data analysis. It allows users to examine data from different perspectives and obtain relevant information for decision-making. OLAP is essential in business intelligence, providing support for complex queries, aggregations and dynamic data visualizations.

In Romania, OLAP is used in various fields such as retail, telecommunications, banking and public administration. Companies use OLAP to analyze customer behavior, for financial forecasts and to optimize operations. (www.hyperledger.org)

The benefits of using OLAP are: fast access to relevant information; multidimensional data analysis; support for strategic decision-making; identification of trends and anomalies; improvement of organizational performance.

Challenges in implementing OLAP are: high implementation costs; the need for a solid IT infrastructure; the complexity of data modeling; the need for staff training.

3. Research methodology

To carry out our research, we based ourselves on discussing data available on the internet and proposing accounting recording solutions.

Among the most used ERP applications in Romania are: (www.ziare.ro)

-SVAP2025: developed by SIMAVI, includes accounting, payroll, management, fixed assets modules.

-SeniorERP: offers advanced accounting, CRM, BI and AI integration functionalities.

-UP2DATE ERP: modular solution with extended functionalities for SMEs and corporations.

-Other local solutions: adapted to Romanian legislation and integrated with ANAF, SAF-T, D112, etc.

Modern ERPs are designed for interoperability with:

- ANAF: automatic transmission of tax returns (D112, D300, D394) and the SAF-T file (D406).

-Banks: automatic reconciliation, statement import, SEPA payments.

-CRM: customer synchronization, orders, invoices.

-HR and Payroll: contracts, timesheets, flyers, vacations.

- WMS: inventory management and logistics traceability.

The payroll modules in ERP allow the automatic calculation of salaries, withholdings and contributions, the generation of flyers, payrolls and the D112 declaration. They also manage employment contracts, timesheets and employee evaluations. (www.ziare.ro)

ERPs provide complete inventory records through input/output documents (NIR, notices, receipts), inventory, traceability and alerts for minimum stocks. Integration with supply and production optimizes logistics flows.

Modern ERPs allow the automatic generation and electronic transmission of tax declarations: D112, D300, D394, D406 (SAF-T), as well as other reports to ANAF, in XML or PDF format electronically signed. (www.ziare.ro)

Examples of use in Romanian companies:

- Banca Transilvania uses OLAP for risk analysis and product portfolio optimization.
- Retailer eMAG uses OLAP for purchasing behavior analysis and inventory management.
- Also, companies in the energy sector, such as Electrica, use OLAP for consumption analysis and forecasts.

4. Findings

According to public sources, the purchases of desktop and laptop IT systems by industries and activity sectors in Romania in the period 2023–2025 are presented in the tables below.

Table no. 1. Manufacturing industry - Distribution by types of computing systems

Type of computing system	Estimated value (lei)
Business	684.745
Home	219.635
Gaming	129.197
Ultraportables	129.197
2-in-1	129.197
Total	1.291.971

Source: Author's processing public data

Table no. 2. Manufacturing industry - Distribution by operating systems

Operating System	Estimated value (lei)
Windows	826.862
Mac OS	335.912
Linux	129.197
Total	1.291.971

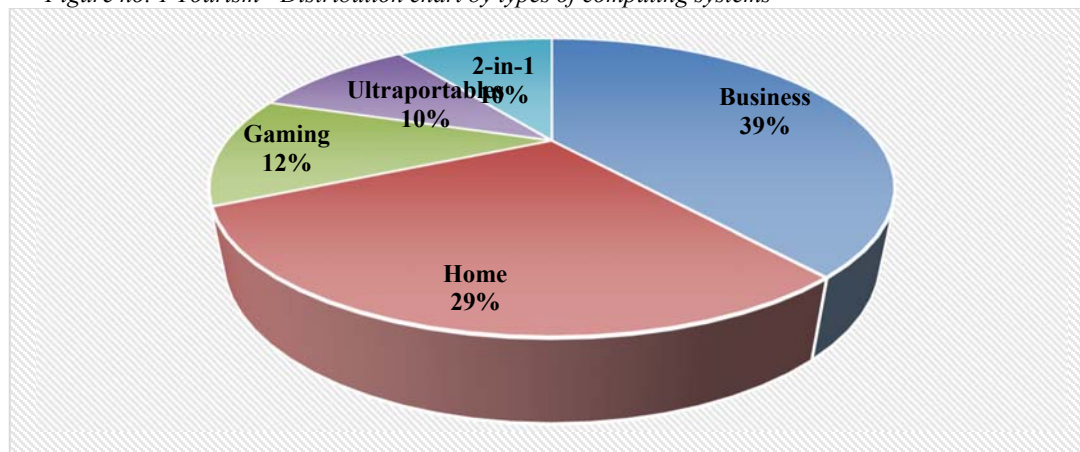
Source: Author's processing public data

Table no. 3. Tourism - Distribution by types of computing systems

Type of computing system	Estimated value (lei)
Business	546.989
Home	406.735
Gaming	168.304
Ultraportables	140.253
2-in-1	140.253
Total	1.402.534

Source: Author's processing public data

Figure no. 1 Tourism - Distribution chart by types of computing systems



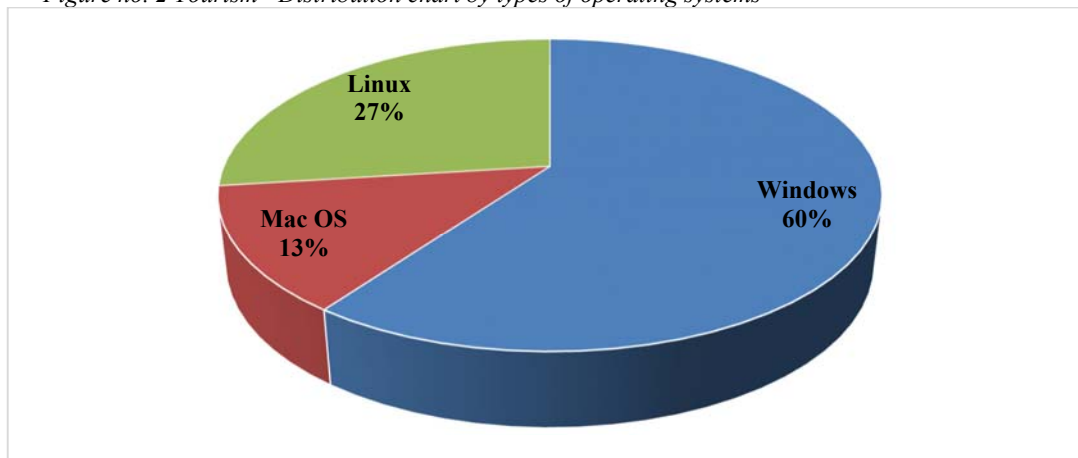
Source: Author's processing public data

Table no. 4. Tourism - Distribution by operating systems

Operating System	Estimated value (lei)
Windows	841.521
Mac OS	182.329
Linux	378.684
Total	1.402.534

Source: Author's processing public data

Figure no. 2 Tourism - Distribution chart by types of operating systems



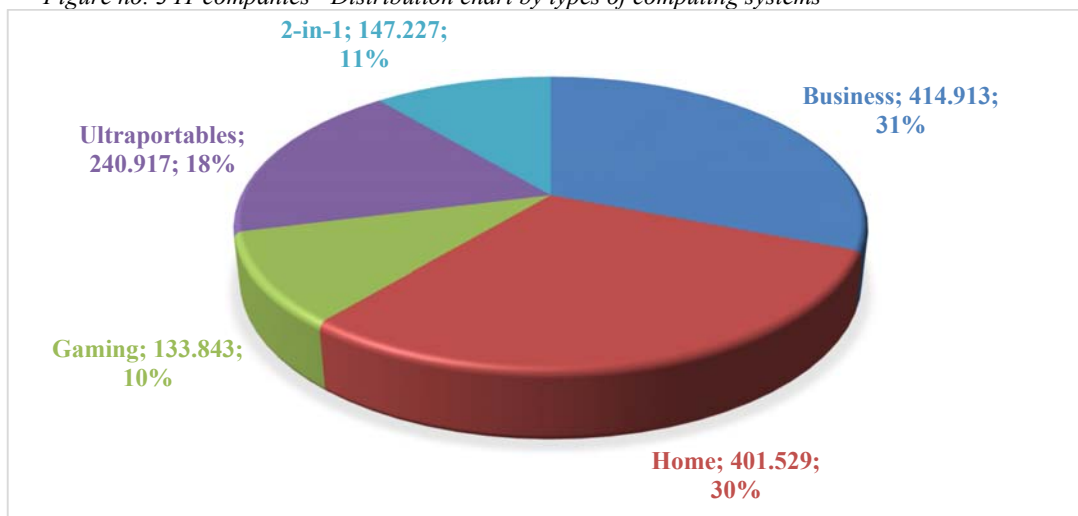
Source: Author's processing public data

Table no. 5. IT companies - Distribution by types of computing systems

Type of computing system	Estimated value (lei)
Business	414.913
Home	401.529
Gaming	133.843
Ultraportables	240.917
2-in-1	147.227
Total	1.338.429

Source: Author's processing public data

Figure no. 3 IT companies - Distribution chart by types of computing systems

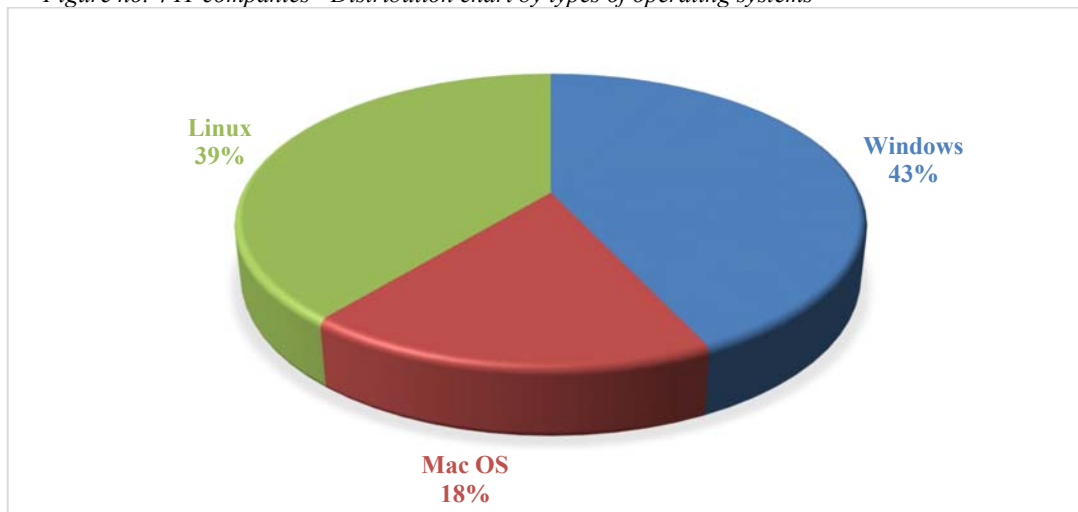


Source: Author's processing public data

Table no. 6. IT companies - Distribution by operating systems

Operating System	Estimated value (lei)
Windows	575.526
Mac OS	240.917
Linux	521.987
Total	1.338.428

Figure no. 4 IT companies - Distribution chart by types of operating systems



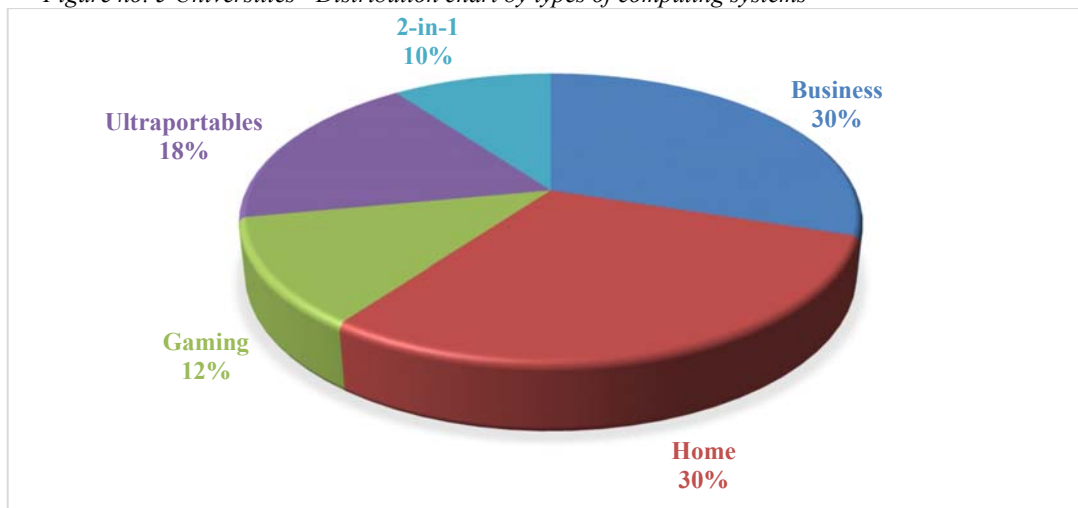
Source: Author's processing public data

Table no. 7. Universities - Distribution by types of computing systems

Type of computing system	Estimated value (lei)
Business	435.939
Home	435.937
Gaming	174.375
Ultraportables	261.562
2-in-1	145.312
Total	1.453.123

Source: Author's processing public data

Figure no. 5 Universities - Distribution chart by types of computing systems



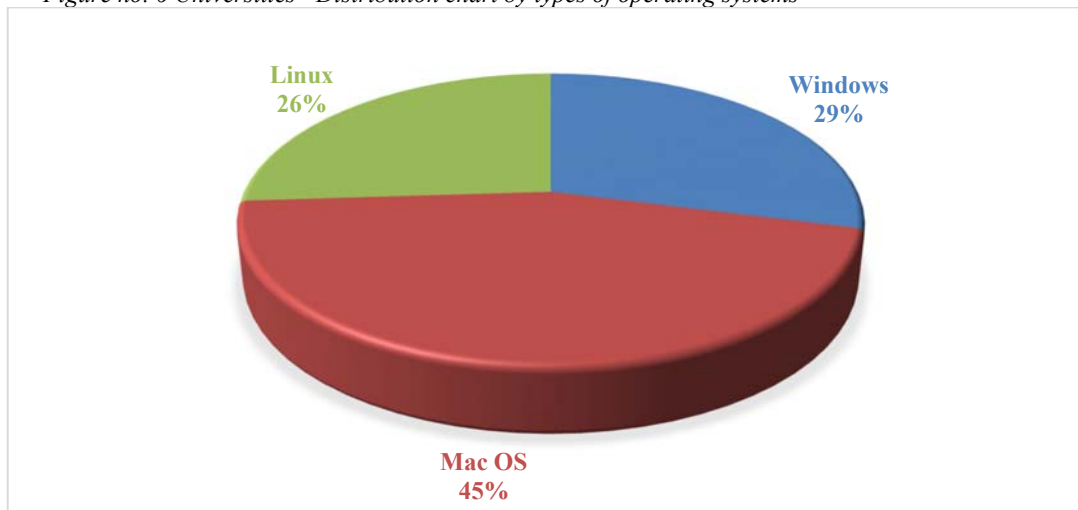
Source: Author's processing public data

Table no. 8. Universities - Distribution by operating systems

Operating System	Valoare estimată (lei)
Windows	421.406
Mac OS	653.906
Linux	377.812
Total	1.453.124

Source: Author's processing public data

Figure no. 6 Universities - Distribution chart by types of operating systems



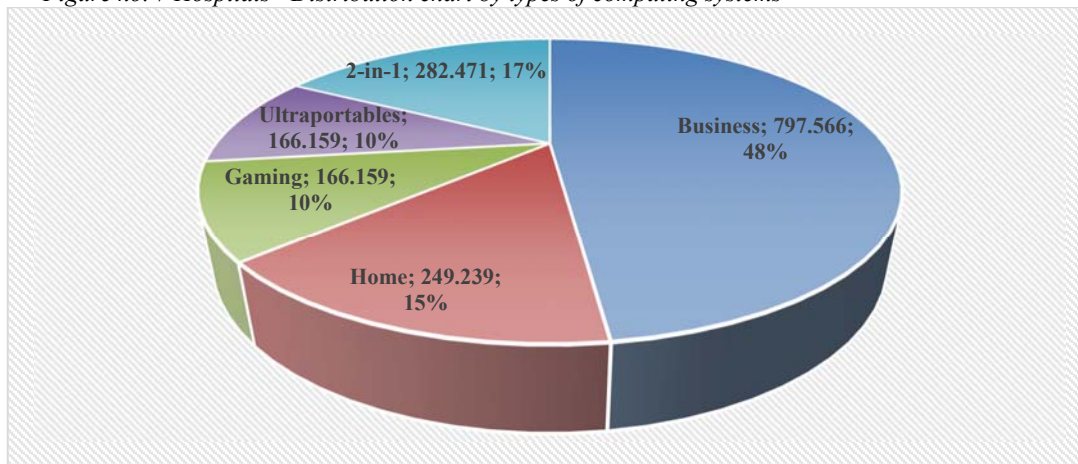
Source: Author's processing public data

Table no. 9. Hospitals - Distribution by types of computer systems

Type of computing system	Estimated value (lei)
Business	797.566
Home	249.239
Gaming	166.159
Ultraportables	166.159
2-in-1	282.471
Total	1.661.593

Source: Author's processing public data

Figure no. 7 Hospitals - Distribution chart by types of computing systems



Source: Author's processing public data

Table no. 10. Hospitals - Distribution by operating systems

Operating System	Estimated value (lei)
Windows	1.296.044
Mac OS	199.391
Linux	166.159
Total	1.661.594

Source: Author's processing public data

The very large acquisitions of computing systems by Romanian entities in the period 2023–2025 represent the technical support necessary for the implementation of new paradigms for processing accounting information in digitalized systems.

5. Case study on accounting information paradigms

Accounting Information -Accounting Proposals - Author

Table no. 11 Transaction history case study on accounting information paradigms

	Description
15.01.2024	The Ultra78 entity purchased computer systems in the amount of 100,000 monetary units (mu), with records in delocalized databases.
15.01.2024	Records are made in delocalized databases.
12.02.2024	The Ultra78 entity purchased computer systems in the amount of 120,000 mu.
12.02.2024	Records are made in delocalized databases.
16.03.2024	The Ultra78 entity purchased computer systems in the amount of 160,000 mu.
16.03.2024	Records are made in delocalized databases.
20.04.2024	The Ultra78 entity purchased computer systems in the amount of 200,000 mu.
20.04.2024	Records are made in delocalized databases.
10.05.2024	The Ultra78 entity purchased computer systems in the amount of 150,000 mu.
10.05.2024	Records are made in delocalized databases.
18.06.2024	The Ultra78 entity purchased computer systems in the amount of 80,000 mu.
18.06.2024	Records are made in delocalized databases.
15.07.2024	The Ultra78 entity purchased computer systems in the amount of 135,000 mu.
15.07.2024	Records are made in delocalized databases.
16.08.2024	The Ultra78 entity purchased computer systems in the amount of 55,000 mu.
16.08.2024	Records are made in delocalized databases.
11.09.2024	The Ultra78 entity purchased computer systems in the amount of 250,000 mu.
11.09.2024	Records are made in delocalized databases.
18.10.2024	The Ultra78 entity purchased computer systems in the amount of 350,000 mu.
18.10.2024	Records are made in delocalized databases.

Source: working hypotheses

Records

Table o. 12 Registration of the acquisition of computer systems

Hypothetical Debit Account	Hypothetical Credit Account	Amount
Computing systems	Computing system providers	100,000

Source: working hypotheses

Table no. 13 Records are made in delocalized databases (BDx)

Hypothetical Debit Account	Hypothetical Credit Account	Amount
BDx - Computing systems	BDx - Computing system providers	100,000

Source: working hypotheses

Table no. 14 Registration of the acquisition of computer systems

Hypothetical Debit Account	Hypothetical Credit Account	Amount
Computing systems	Computing system providers	120,000

Table no. 15 Records are made in delocalized databases (BDx

Hypothetical Debit Account	Hypothetical Credit Account	Amount
BDx - Computing systems	BDx -- Computing system providers	120,000

Source: working hypotheses

Table no. 16 Registration of the acquisition of computer systems

Hypothetical Debit Account	Hypothetical Credit Account	Amount
Computing systems	Computing system providers	160,000

Source: working hypotheses

Table no. 17 Records are made in delocalized databases (BDx

Hypothetical Debit Account	Hypothetical Credit Account	Amount
BDx - Computing systems	BDx - Computing system providers	160,000

Source: working hypotheses

Table no. 18 Registration of the acquisition of computer systems

Hypothetical Debit Account	Hypothetical Credit Account	Amount
Computing systems	Computing system providers	200,000

Source: working hypotheses

Table no. 19 Records are made in delocalized databases (BDx

Hypothetical Debit Account	Hypothetical Credit Account	Amount
BDx - Computing systems	BDx - Computing system providers	200,000

Source: working hypotheses

Table no. 20 Registration of the acquisition of computer systems

Hypothetical Debit Account	Hypothetical Credit Account	Amount
Computing systems	Computing system providers	150,000

Source: working hypotheses

Table no. 21 Records are made in delocalized databases (BDx

Hypothetical Debit Account	Hypothetical Credit Account	Amount
BDx - Computing systems	BDx - Computing system providers	150,000

Source: working hypotheses

Table no. 22 Registration of the acquisition of computer systems

Hypothetical Debit Account	Hypothetical Credit Account	Amount
Computing systems	Computing system providers	80,000

Source: working hypotheses

Table no. 23 Records are made in delocalized databases (BDx

Hypothetical Debit Account	Hypothetical Credit Account	Amount
BDx - Computing systems	BDx - Computing system providers	80,000

Source: working hypotheses

Table no. 24 Registration of the acquisition of computer systems

Hypothetical Debit Account	Hypothetical Credit Account	Amount
Computing systems	Computing system providers	135,000

Source: working hypotheses

Table no. 25 Records are made in delocalized databases (BDx

Hypothetical Debit Account	Hypothetical Credit Account	Amount
BDx - Computing systems	BDx - Computing system providers	135,000

Source: working hypotheses

Table no. 26 Registration of the acquisition of computer systems

Hypothetical Debit Account	Hypothetical Credit Account	Amount
Computing systems	Computing system providers	55,000

Source: working hypotheses

Table no. 27 Records are made in delocalized databases (BDx)

Hypothetical Debit Account	Hypothetical Credit Account	Amount
BDx - Computing systems	BDx - Computing system providers	55,000

Source: working hypotheses

Table no. 28 Registration of the acquisition of computer systems

Hypothetical Debit Account	Hypothetical Credit Account	Amount
Computing systems	Computing system providers	250,000

Source: working hypotheses

Table no. 29 Records are made in delocalized databases (BDx)

Hypothetical Debit Account	Hypothetical Credit Account	Amount
BDx - Computing systems	BDx - Computing system providers	250,000

Source: working hypotheses

Table no. 20 Registration of the acquisition of computer systems

Hypothetical Debit Account	Hypothetical Credit Account	Amount
Computing systems	Computing system providers	350,000

Source: working hypotheses

Table no. 31 Records are made in delocalized databases (BDx)

Hypothetical Debit Account	Hypothetical Credit Account	Amount
BDx - Computing systems	BDx - Computing system providers	350,000

Source: working hypotheses

6. Conclusions

The present article presented a set of ideas and data regarding the trends in the processes of implementing accounting information paradigms in digitalized systems.

The expansion of the possibilities of multiple processing of accounting data in the accounting of entities can be observed.

The acquisitions of significant computing systems by the entities in Romania mentioned in our article constitute the technical support necessary for the development of paradigms of digitalized processing of accounting information by entities in Romania.

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Best Practices in Internal Control, Auditing, and Sustainable Investment Efficiency

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Abstract

This paper explores the connection between internal control, audit, and the efficiency of sustainable investments. The study is structured around three pillars: best practices in internal control, audit, and sustainable investment performance. Using a qualitative approach, it draws from academic literature, and expert guidelines.

The first pillar examines how strong internal control systems such as those based on the COSO framework and automation technologies help manage ESG-related risks and support financial performance.

The second pillar highlights the role of audit in increasing transparency and investor trust, focusing on auditor independence, ISA standards, and modern tools like data analytics and AI.

The third pillar investigates how effective internal controls and auditing improve the impact and credibility of ESG investments by reducing greenwashing risks and enhancing non-financial reporting.

The study underscores the strategic importance of audit and control systems in fostering responsible and efficient investment practices.

Key words: audit, ESG, sustainable investment, internal control

J.E.L. classification: M42, G15

1. Introduction

In the current context of global pressures toward a green and responsible economy, organizations are increasingly aware of the importance of integrating ESG (Environmental, Social, Governance) criteria into their financial strategies. Within this framework, internal control and both internal and external audit play a fundamental role in strengthening investor confidence and increasing the efficiency of sustainable investments. A well-designed internal control system contributes to identifying, monitoring, and managing ESG risks, while the audit function provides assurance and independence regarding the accuracy and transparency of reported information.

Recent studies show that companies investing in ESG audit and assurance services reduce reputational risks and improve their perceived market value. Therefore, the interdependence between internal control, audit, and sustainability reporting not only supports compliance and corporate governance but also becomes a strategic element essential for attracting capital and maximizing long-term value (Asante & Lambert, 2023).

The purpose of this research paper is to analyze the relationship between the three concepts: internal control, audit, and the efficiency of sustainable investments, as well as their interdependence in the current economic context. This topic is highly relevant in a world where technology evolves at an incredible pace, and new professions, techniques, and technologies are constantly emerging,

transforming processes through automation and reducing execution time, thereby increasing organizational efficiency. In this context, starting from the literature, this paper aims to answer the following research questions:

RQ: Do best practices in internal control, along with rigorous auditing, increase the efficiency of sustainable investments? To answer this question this study used a qualitative analysis approach, focusing on the examination of multiple academic articles from Web of Science database about best practices in internal control, audit, and sustainable investment performance. This study aims to fill gaps in literature through an empirical approach by examining the connection between these three concepts.

As it turns out, alongside these technological developments, the concept of sustainability has also gained widespread popularity over time, with sustainable investments becoming increasingly common alongside non-financial reporting, which remains difficult to quantify.

2. Literature review

2.1 Internal Control – Best Practices

Internal control has become one of the most important tools for companies seeking to develop self-discipline and improve managerial performance. The Committee of Sponsoring Organizations of the Treadway Commission (COSO) identifies two key ways in which internal control systems influence corporate sustainability. First, internal control enhances operational effectiveness and efficiency while ensuring compliance with applicable laws and regulations, thereby contributing to future performance improvement. Second, it increases the reliability of reports produced and published by companies, enabling stakeholders to more accurately assess and monitor the firm's sustainability (Ja & Eun, 2020). However, there is limited empirical evidence regarding the impact of internal control on corporate sustainability indicators.

Internal control encompasses various control activities aimed at achieving a firm's managerial objectives. Its importance has grown especially after the U.S. adopted the Sarbanes-Oxley Act (SOX) following the Enron scandal, which introduced strict regulations for establishing and maintaining internal control systems. Since SOX implementation, academic research on internal control systems has intensified. These studies typically fall into two categories: one focuses on the characteristics of firms with integrated internal control systems (ICWs), while the other explores the effects of ICWs on stakeholders, such as market responses and capital cost implications (COSO, 2013).

Management is responsible for designing, implementing, and maintaining effective internal controls, while the audit committee oversees these controls (COSO, 2013). Internal auditors provide independent assessments of control effectiveness but do not participate in their design or implementation (COSO, 2015). In public companies, management is required to report publicly on the effectiveness of internal controls over financial reporting (ICFR). In the presence of significant deficiencies, management must declare the ICFR as ineffective. Internal auditors assist in evaluating ICFR in accordance with Section 404(a) of SOX, maintaining the objectivity required by the Institute of Internal Auditors (IIA), 2012.

However, their objectivity may be compromised by the influence of management or the audit committee over the internal audit function (IAF), as well as by the type of deficiency under review. Since these parties are part of the internal control system, internal auditors may hesitate to report deficiencies that could harm the organization's image. Studies show that auditors are less likely to classify pervasive deficiencies (e.g., "tone at the top") as material weaknesses, compared to process-specific issues. Additionally, when top management exerts primary influence over the IAF, auditors may downplay procedural deficiencies. Predominant oversight by the audit committee can also lead to underreporting of issues where the committee itself is a control weakness – a problem only external auditors can correct through independent testing. These findings highlight how organizational context and power dynamics can influence internal auditors' evaluations, with potential implications for the quality of reported information (Gramling & Schneider, 2018).

A fundamental principle of control activities is the segregation of duties. For example, "Segregation of duties between programmers and operational staff significantly reduces the risk that these individuals, possessing programming knowledge, might introduce intentional errors or malicious code without detection" (Curtea de Conturi, 2012).

To ensure the quality of financial and non-financial reporting, especially in the context of sustainability, the standards issued by the International Auditing and Assurance Standards Board (IAASB) provide an essential framework. ISSA 5000 establishes principles for ESG assurance engagements, requiring a rigorous understanding of internal control and, in the case of reasonable assurance, testing its effectiveness. Furthermore, ISAE 3000 (Revised) and ISAE 3410 regulate non-financial reporting and greenhouse gas emissions disclosures, helping combat greenwashing. ISA 315 emphasizes risk assessment from the perspective of internal control systems, including the ESG dimension. In addition, ISAE 3402 offers assurance over service providers' controls, supporting ESG data reliability across the supply chain. Collectively, these standards promote strong governance, enhance investor trust, and improve the efficiency of sustainable investments (IAASB).

2.2 Audit – best practices

To ensure transparency, credibility, and rigor in qualitative research, the literature recommends the use of a clearly defined audit procedure. This involves full documentation of the research process (audit trail), the involvement of an independent auditor with domain expertise, and a clear definition of the auditor's role. Such a procedure strengthens the validation of interpretations and facilitates replicability. Furthermore, publishing the audit trail and the criteria used to select the auditor is encouraged, as it enhances the transparency of the scientific process (Rodgers & Cowles, 2018).

Building on the importance of audit committees, the article "Firm Characteristics and Audit Committees Complying with 'Best Practice' Membership Guidelines" (Rainsbury, Bradbury, & Cahan, 2008) analyzes how the characteristics of firms in New Zealand influence the voluntary adoption of audit committees that meet best practice standards. The study finds that demand-side factors (e.g., investor pressure) are not significant drivers, whereas supply-side factors, such as firm size and board independence, are highly influential. Larger firms with more independent boards are more likely to implement audit committees aligned with best practices. These findings suggest that internal structural characteristics play a more important role than external pressures in promoting effective financial governance.

In a related context, the article "Assessing the Impact of the New Auditor's Report" (Li, Hay, & Lau, 2019) examines the effects of introducing new auditor reporting standards, particularly the inclusion of "Key Audit Matters" (KAMs), on audit quality and transparency. The study demonstrates that the inclusion of KAMs has led to improved communication between auditors, management, and investors, offering clearer insight into significant risks and critical areas in the financial statements. The authors also note that the new standards have encouraged more rigorous auditor behavior and greater accountability to stakeholders. However, the effectiveness of these practices depends on the quality of disclosures and the extent to which auditors engage in explaining their professional judgments. Thus, the consistent and detailed application of the new reporting standards is considered the best practice that contributes to strengthening trust in financial governance.

Returning to the study by Rainsbury, et al., (2008), the article reiterates that external demand factors such as investor pressure do not significantly influence the formation of high-quality audit committees. Instead, supply-side characteristics - particularly firm size and board independence - are key to the adoption of best practice frameworks. This reinforces the idea that robust corporate governance mechanisms are more likely to be adopted in large firms with the internal capacity to absorb the costs and efforts involved in implementing such standards.

Finally, the article "How Do Sustainability Assurance, Internal Control, Audit Failures Influence Auditing Practices?" (Alabdullah, 2023) highlights the growing role of internal control automation through IT tools, ERP systems, and AI-based monitoring in strengthening internal audit practices. Interviewed auditors report that a robust internal control system supported by technology not only improves audit quality but also drives the adoption of electronic auditing tools (e.g., data analytics, real-time dashboards). Automation enables auditors to identify deficiencies more quickly, efficiently,

and accurately, enhancing the consistency and rigor of evaluations. Moreover, it allows for continuous and dynamic oversight—critical elements in ESG-integrated auditing and in boosting the efficiency of sustainable investments by reducing risks and increasing confidence in reported data.

2.3 Sustainable investment

The article investigates the impact of sustainability assurance on the cost of capital in financial markets, offering relevant insights into the efficiency of sustainable investments. The study finds that firms which externally verify their sustainability reports (third-party sustainability audits) benefit from a lower cost of capital. This suggests that investors perceive such firms as more transparent and accountable. The reduction in capital costs is more pronounced among large firms and in industries with significant ESG exposure, indicating that sustainable investments become more efficient when there is confidence in the quality and verifiability of non-financial information. Therefore, sustainability assurance is identified as a key best practice in promoting efficient sustainable investments and attracting capital at competitive rates (Liyanarachchi & Lee, 2022).

Expanding on this, another study explores the relationship between the quality of ESG reporting and firm value, emphasizing the impact of transparency and assurance practices on sustainable investment efficiency. The findings reveal that firms producing high-quality ESG reports, complemented by independent external assurance, tend to receive higher market valuations and experience reduced capital costs—indicators of greater investment efficiency. Furthermore, ESG assurance acts as a mechanism for reducing information asymmetry, increasing investor trust and enabling more informed capital allocation decisions. Thus, the quality and verifiability of ESG reporting emerge as key drivers of sustainable investment efficiency in today's finance landscape (Chen, Liu, & Wang, 2023).

In a similar vein, the article "Does ESG performance affect firm value? Evidence from global firms" (Zhang & Zhu, 2023) demonstrates that companies with higher ESG scores enjoy greater market value, reflecting superior efficiency in sustainable investing. This positive effect is stronger in countries with robust institutional frameworks and strict sustainability regulations. Strong ESG performance lowers perceived non-financial risks and boosts investor confidence, contributing to lower capital costs and increased long-term funding. The study confirms that sustainable investments are more efficient when ESG practices are not only reported but genuinely implemented within institutional environments that reward transparency and corporate responsibility.

Adding a broader perspective, the article "Sustainable finance and investment efficiency: A bibliometric and thematic review" (Khan et al., 2023) offers an extensive bibliometric analysis of sustainable finance literature. It finds that sustainable investing is becoming increasingly influential in global financial decision-making, with ESG integration correlating with more efficient capital allocation, reduced risk, and improved long-term performance. The authors highlight that sustainable investment efficiency is supported not only by ESG performance itself, but also by the quality of reporting, the presence of external sustainability assurance, and strong institutional frameworks—as previously concluded by Chen et al. (2023), Zhang & Zhu (2023), and Liyanarachchi & Lee (2022). The paper reinforces the notion that transparency, independent assurance, and the real integration of sustainability into business strategy are critical for building investor trust and ensuring the effective deployment of green capital. As such, it adds depth and consistency to existing research, affirming that ESG reporting and audit best practices play an essential role in maximizing investor value and advancing the transition toward a sustainable financial system.

Lastly, the article "Does environmental, social and governance performance improve firm value? Evidence from panel data analysis" (García-Sánchez et al., 2023) provides strong empirical evidence linking ESG performance with firm value growth, directly supporting the notion of sustainable investment efficiency. Based on a large dataset of European firms, the authors show that strong ESG performance enhances firm value by reducing investor-perceived risk and improving corporate reputation. The study also notes that the positive impact of ESG is stronger in environmentally sensitive industries and among firms with robust corporate governance.

Therefore, responsible ESG integration is not only a moral or legal obligation but also an effective strategy for capital attraction and sustainable growth, consistent with the conclusions of Khan et al. (2023), Chen et al. (2023), and Zhang & Zhu (2023). The findings reinforce the idea that sustainable investments are more efficient when firms are transparent, accountable, and genuinely committed to sustainability, supported by strong systems of audit and reporting.

3. Research methodology

This research contains a qualitative analysis approach, focusing on the examination of multiple academic articles addressing internal control, audit, and the efficiency of sustainable investments from a global perspective. The articles were sourced from reputable databases such as Web of Science. Using such reputable databases ensures academic reliability and relevance of the selected materials.

In addition to peer-reviewed academic literature, the study also considered reports and publications from respected institutions in the field, including COSO, IAASB, and national audit institutions such as the Romanian Court of Accounts. The aim was not to limit the investigation to the European context but to provide a global perspective on the three pillars analyzed, enabling a broader understanding and the identification of internationally applicable best practices.

The decision to adopt a macro-level qualitative approach was made to lay the groundwork for future research directions. The selection of articles was based on a rigorous filtering process, structured around the three main thematic categories of the research: internal control, audit, and the efficiency of sustainable investments. The aim was to ensure that relevant and high-quality sources were identified for each dimension under analysis.

The filtering criteria included: articles published in English, primarily from the field of economics, and peer reviewed. While no regional restrictions were applied, given the objective of offering a global perspective, specific thematic filters were applied in successive stages. First, the focus was on literature addressing internal control systems and best practices. Next, the search was refined to include studies comparing internal versus external audit practices, emphasizing recognized standards and guidelines. Finally, the selection targeted articles discussing the efficiency of sustainable investments, with attention to ESG integration, transparency, and investor trust.

This stepwise filtering ensured thematic consistency and the relevance of each source to the respective research pillar.

Table no. 1: Best practices connecting internal control, audit, and sustainable investment efficiency

Domain	Best Practice	Impact on the Efficiency of Sustainable Investments
Internal control	COSO framework & SoD	Increased stakeholder trust Reduced fraud risks
External/internal audit	Documented audit trail AI-based monitoring Key audit matters	Improved transparency Reduced information asymmetry
IAASB Standards	ISSA 5000, ISAE 3000/3410/3402 ISA 315	Quality of ESG reporting ensured Governance strengthened
Sustainability assurance	External audit of ESG reports and their real integration into the strategy	Reduced cost of capital Increased market value
ESG performance	Quality ESG reporting Solid governance	Increased investment efficiency, especially in ESG-sensitive industries

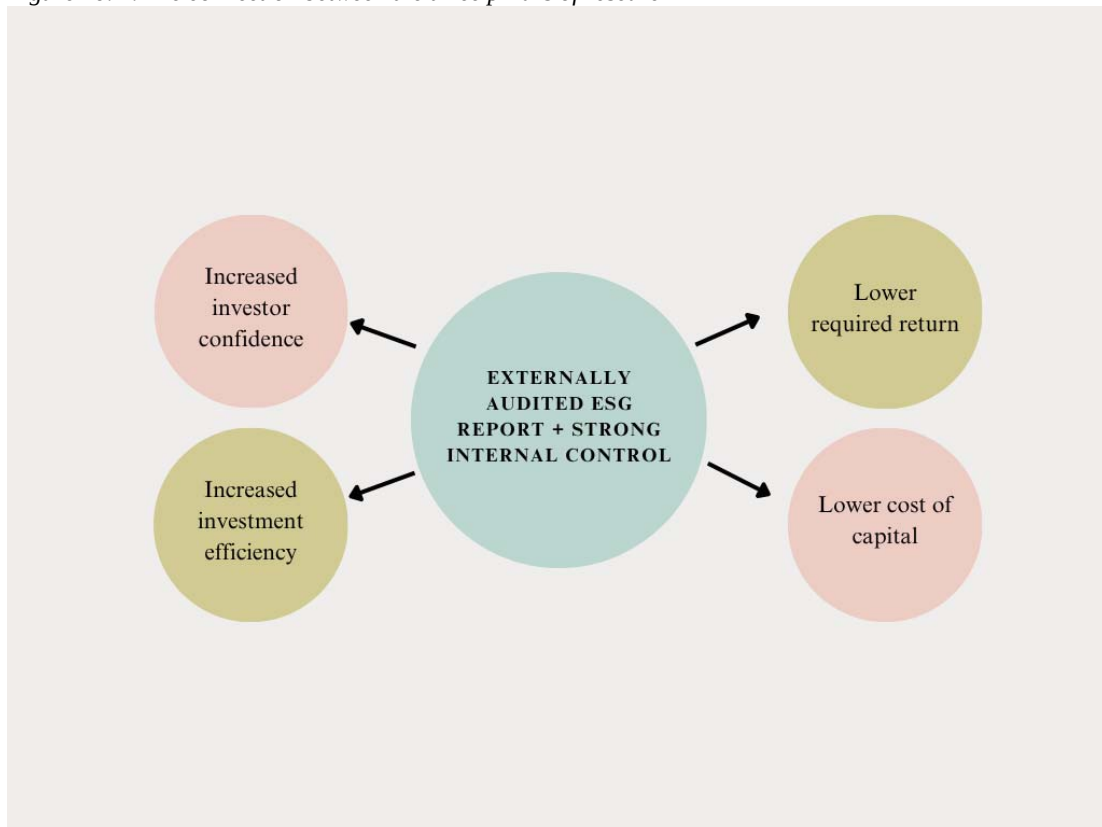
Source: Author's own research

4. Findings

Starting from the research question RQ: *Do best practices in internal control, along with rigorous auditing, increase the efficiency of sustainable investments?*, a qualitative analysis was performed based on carefully selected data of articles published on Web of Science.

In an economic landscape increasingly shaped by ESG criteria, companies' ability to attract efficient sustainable investments largely depends on the quality of internal control and audit. Robust internal control ensures the transparency and accuracy of both financial and non-financial reporting, while auditing provides independent validation of this information, which is essential for investor trust. Research by (Lisic, Myers, Seidel, and Zhou 2019) demonstrates that accounting expertise within audit committees plays a crucial role in supporting high-quality auditing, especially in identifying and reporting internal control deficiencies. An audit committee composed of members with strong accounting competencies creates an environment in which auditors can operate with greater independence and rigor, accurately reporting weaknesses in internal control systems. This dynamic not only strengthens corporate governance but also directly contributes to the efficiency of sustainable investments by reducing informational risks and enhancing firms' credibility in capital markets.

Figure no. 1. The connection between the three pillars of research



Source: Author's own research

A robust internal governance and internal control system, assessed and confirmed by external audit, including reports enriched with Key Audit Matters (according to ISA701) determines a significant reduction in reported risk elements (Fera et al., 2021). Thus, it gives investors a greater level of confidence in the reliability of ESG information. This increase in credibility reduces the perception of risk, decreases the required return, and implicitly lowers the cost of capital, essential conditions for increasing the efficiency of sustainable investments.

The implementation of ERP systems has a significant impact on internal control and audit practices. This is because these systems integrate workflows and databases, allowing for improved traceability and reducing the risks of human error. ERPs contribute to the automation of internal controls and can introduce new risks if not properly configured. For internal auditors, ERP systems offer opportunities to perform more efficient checks through access to real-time data but also require the development of new technical skills. Thus, the relationship between ERP, internal control and audit is one of interdependence, in which the quality of the audit depends on the maturity and governance of the ERP system (Grabski, Leech & Schmidt, 2011).

5. Conclusions

The research paper presents the results of a systematic literature review on the best practices in internal control, auditing and sustainable investments. Using a qualitative approach the analysis included articles from Web of Science database divided into 3 pillars: best practices in internal control, best practices in audit, and sustainable investment performance, using these keywords as filters in the selection of the articles.

Results suggest that when best practices in internal control are strong and well implemented and auditing is rigorous, sustainable investments become more efficient: the cost of capital decreases, the perceived risk is lower, and capital is optimally allocated. An externally audited ESG report according to ISAE 3000, supported by a solid internal control system, will be considered trustworthy by investors. They will demand a lower return, and the company will access capital at a lower cost. Ultimately, leading to increased efficiency of sustainable investment.

While the methodology used offers a comprehensive overview, it also comes with limitations. Notably, the study does not include quantitative analysis, nor does it incorporate sector-specific corporate reports or interviews methods that could have been helpful in identifying literature gaps and offering more targeted insights.

Nevertheless, this exploratory phase provides a valuable foundation for establishing future research objectives and can serve as a reference for other researchers seeking to explore which are the best practices connecting internal control, audit, and sustainable investment efficiency from a global standpoint.

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Taxation of Corporate Profits in Romania and Poland: Key Similarities and Differences

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Abstract

This paper conducts a comparative analysis of profit taxation systems in Romania and Poland, considering the fiscal, economic, and social impact of this type of direct tax. Profit tax, applied to the taxable income of legal entities, significantly influences public revenues, investment decisions, and the economic behavior of agents. The study aims to highlight how differences in the structure, rates, and fiscal policies of the two countries affect the competitiveness of the business environment and the equitable distribution of resources.

The purpose of this study is to analyze the extent to which differences between the tax systems in Romania and Poland influence the behavior of economic agents, affect the competitiveness of the business environment, and determine the orientation of public policies by examining how tax structures shape decisions, market dynamics, and governmental approaches.

The overall objective is to identify the similarities and differences in the structure and policies of profit taxation in the two countries.

Key words: fiscal system, taxes, corporate income tax, fiscal policy, tax competitiveness

J.E.L. Classification: H25, H21, H32, H87, F36

1. Introduction

In the current global economic context, taxation plays a fundamental role not only in mobilizing public financial resources, but also in shaping the behavior of economic agents. Among the taxes with a major impact on entrepreneurial decisions and on attracting investment is income tax, a direct tax applicable to the financial results of the enterprise, with direct implications for the profitability of economic activities. As one of the main instruments of fiscal policy, this tax is regulated differently in each jurisdiction, depending on the economic priorities, administrative capacity, and socio-political context of the state.

Romania and Poland are emerging economies in Central and Eastern Europe, both members of the European Union, in the process of fiscal consolidation and alignment with European directives. Their economic development is marked by ongoing efforts to integrate EU fiscal standards while maintaining growth and stability within their national frameworks. Although they share common features, such as post-communist transition and pro-investment orientation, the two countries have adopted distinct fiscal strategies regarding profit taxation, including applicable rates, special regimes for SMEs, research and development incentives, and the approach to profit reinvestment.

The choice of this topic is justified by the growing importance of tax competitiveness in a globalized economic climate and the need for EU Member States to balance the need to attract private capital with budgetary sustainability. At the same time, in an era where digitalization, sustainability, and good governance are becoming key priorities, it is necessary to critically reflect on the effectiveness of current tax policies and how they stimulate responsible economic behavior.

From a scientific perspective, a comparative analysis of corporate income tax between two EU member states allows for a better understanding of the relationship between taxation, economic performance, and voluntary compliance. By correlating statistical data, macroeconomic indicators, and the legislative framework, the research proposes a rigorous assessment of the impact of fiscal policies on investment, economic development, and budgetary balance.

The purpose of this paper is to compare the profit taxation systems in Romania and Poland to identify the main similarities and differences, their economic implications, and possible directions for improvement in Romania in the context of European convergence.

The main objective is to assess the efficiency and attractiveness of national tax systems in relation to their impact on investment and tax compliance.

The main research questions are:

- To what extent does the structure of profit tax influence the fiscal competitiveness of the two countries?
- How do tax policies contribute to attracting foreign direct investment?
- What good practices from Poland can be adapted to the Romanian context?

Through the proposed comparative and analytical approach, the paper contributes to the substantiation of possible tax reforms and offers relevant perspectives for academia, decision-makers, and investors interested in Central and Eastern Europe.

2. Literature review

Income tax is one of the most studied areas of taxation, as it has a direct impact on public resources, companies' economic decisions, and the investment attractiveness of an economy. In economic and financial literature, numerous authors have analyzed the role and efficiency of this tax in various national and international contexts, emphasizing the relationship between the tax rate, tax compliance, capital mobility, and the redistributive effects of fiscal policy.

Fundamental concepts regarding income tax. Musgrave and Musgrave (1989) conceptually substantiated the distinction between the allocative, redistributive, and stabilizing functions of taxation, arguing that direct taxes, such as income tax, play a central role in ensuring fiscal equity and directing resources toward strategic priorities. Similarly, Tanzi and Zee (2000) stressed that income tax must be evaluated not just by the revenue it brings to the budget, but also by the distortions it may cause in economic behavior. They highlighted the importance of considering both fiscal outcomes and the broader economic consequences when assessing income tax. The focus should not be limited to how much money is collected, but also include how taxation influences decisions made by individuals and businesses. Their approach underlines the dual impact of income tax, both as a tool for generating public funds and as a factor affecting economic activity.

Economic theory recognizes that, although corporate income tax has a solid justification in the equitable redistribution of the tax burden, its application can reduce incentives for investment, innovation, and business expansion. These effects are even more important in emerging economies, where the entrepreneurial environment is still fragile and sensitive to excessive fiscal pressures (Auerbach & Poterba, 1987; Gravelle, 2014).

Taxation models and their impact on the business environment. The classic profit taxation model, based on calculating the difference between total income and deductible expenses, is applied in most countries, with significant variations in terms of rates, tax base, preferential regimes, and tax incentives. In recent years, more research has focused on effective tax rates (ETR) as a more relevant indicator than the statutory rate in assessing the actual tax burden on firms (Devereux & Griffith, 2003).

In an analysis of 28 European countries, Spengel et al. (2020) demonstrated that the differences between the statutory and effective rates can be significant due to deductions, tax credits, and favorable treatment of certain types of income or investments. In this perspective, the effective tax rate provides a more realistic picture of a country's tax competitiveness and is often used by investors to assess the attractiveness of a business environment.

Tax compliance and evasion in relation to income tax. An important issue addressed in recent literature is that of tax compliance and tax evasion in relation to corporate income tax. Kirchler (2007) and Alm et al. (2012) highlighted the role of trust in public institutions and the perception of fairness of the tax system in determining the degree of voluntary compliance. In emerging economies, the level of tax evasion associated with income tax remains high, significantly affecting the efficiency of fiscal policy (IMF, 2023).

In this regard, Romania is often cited in European Commission and OECD reports as an example of a country with a relatively low level of tax revenue collection relative to GDP, despite an attractive statutory rate. In contrast, Poland has managed to increase compliance by digitizing the Polish National Revenue Administration, introducing electronic tax registers, and strengthening administrative capacity (OECD, 2022).

Tax incentives and investment promotion policies. Tax incentives for investment and research and development have become common practice in Central and Eastern Europe to attract foreign capital and encourage structural transformation of economies. According to a PwC report (2023), Romania offers limited incentives for profit reinvestment, particularly in technological assets, while Poland has implemented the Estonian model (CIT Eston), which allows taxation to be deferred until profits are distributed.

The literature shows that these measures can have a positive effect on company capitalization, reducing short-term tax pressure and stimulating reinvestment (Zee et al., 2002; Loretz, 2008). Tax credits for R&D are also considered effective in attracting innovative companies, with a positive long-term impact on productivity and economic competitiveness (Hall & Van Reenen, 2000; Evers, Miller & Spengel, 2015).

Taxation and foreign direct investment (FDI). Another common theme in the literature is the analysis of the relationship between taxation and foreign direct investment flows. According to studies conducted by De Mooij and Ederveen (2008), when the effective tax rate decreases by one percentage point, the volume of foreign direct investment (FDI) can increase, on average, by 2.9%, which highlights the sensitivity of international investors to the actual level of the tax burden. However, this relationship is influenced by other factors such as legislative stability, infrastructure quality, skilled labor, and integration into global value chains.

Compared to other countries in the region, Poland has managed to become a regional hub for FDI thanks to a predictable tax framework and coherent policies to attract investors (UNCTAD, 2022). Romania, on the other hand, despite applying a 16% rate—among the lowest in the EU—has had difficulty maintaining a steady pace of FDI, an issue associated in the literature with regulatory instability and the lack of an integrated incentive system (Dragotă & Ciobanu, 2021).

Tax harmonization in the European Union. At the European Union level, the literature reflects intense debates on the need to harmonize profit taxation systems, in the context of high capital mobility and the phenomenon of "tax competition" between states. Projects such as BEFIT (Business in Europe: Framework for Income Taxation) or the OECD's Pillar II on global minimum tax have generated a new wave of research on the impact of harmonization on national fiscal autonomy (Fuest et al., 2011; Devereux et al., 2021).

Poland and Romania are actively involved in these processes, but the literature emphasizes that the benefits of harmonization depend on the ability of states to implement administrative and digital reforms that support the new rules. In this regard, the digitization of ANAF, the implementation of SAF-T, and e-Invoicing are topics recently addressed in Romanian applied research, with a focus on reducing the tax gap (Cojocariu, 2022).

Gaps and contribution of this research. Although there is extensive literature on the analysis of taxation at the European level, comparative studies between Romania and Poland remain relatively few and fragmented. Most studies either focus on descriptive analyses or treat the two countries separately. There is a lack of research that compares in depth the efficiency of corporate tax systems, correlating fiscal indicators, compliance, investment incentives, and macroeconomic impact.

This paper aims to help bridge that gap by offering a systematic, up-to-date, and policy-oriented analysis that can help both researchers and tax policymakers find effective and adaptable solutions in the context of European convergence.

3. Research methodology

This paper is based on a mixed methodological approach, combining qualitative and quantitative analysis, to make a rigorous comparison between the profit taxation systems in Romania and Poland. The main method used is comparative analysis, which has made it possible to

highlight the differences and similarities between the two tax regimes in terms of efficiency, investment attractiveness, and economic sustainability.

From a quantitative perspective, statistical data were gathered and examined regarding legal and effective tax rates, profit tax revenue in the state budget, the share of foreign direct investment (FDI) in GDP, the level of tax compliance, and tax evasion estimates. This analysis involved assessing numerical indicators related to taxation and investment to provide a clear understanding of the fiscal environment. Each data set contributed to forming an overall picture of how profit taxation affects economic behavior and government income. The investigation focused strictly on measurable figures to ensure objective evaluation of the relationship between taxation and economic performance. The information presented was obtained from official and credible sources, including the National Agency for Fiscal Administration (ANAF) for data from Romania, Statistics Poland for data from Poland, as well as international reference institutions such as Eurostat, the Tax Foundation, the Organization for Economic Cooperation and Development (OECD), and the European Commission. The data was processed using descriptive methods, highlighting the evolution of the indicators over a five-year period (2020–2024) and the correlations between them.

In terms of quality, the research focused on the legislative analysis of the tax codes applicable in both countries, the assessment of tax incentives for investment and innovation (including the exemption regime for reinvested profits, facilities for research and development activities, and special economic zones), as well as the interpretation of the economic implications of national tax policies. It also looked at how the tax regime contributes to the overall competitiveness of the economy and to attracting investment.

The paper also included elements of European tax benchmarking, comparing the two systems to major trends in the European Union, such as tax harmonization, global minimum tax, and the transition to sustainable taxation. This approach enabled the formulation of relevant conclusions and recommendations for improving fiscal policies in Romania, inspired by Polish best practices.

In conclusion, the methodology applied allowed for an in-depth, multidimensional, and contextualized analysis of the subject, highlighting not only the technical differences between the two tax systems, but also their economic and strategic implications in the current European context.

4. Findings

Following the research undertaken, which combined qualitative and quantitative analysis of the profit taxation systems in Romania and Poland, a series of relevant results were identified that reflect the structure, functioning, and impact of these tax systems during the period 2020–2024. The analysis was based on official data, legislative sources, and comparative assessments, with the aim of capturing the complexity of the tax phenomenon and its economic implications.

Tax rates and tax architecture. A comparative analysis of corporate income tax rates in Romania and Poland highlights significant differences in both the statutory rate and the effective tax rate. Romania applies a statutory corporate income tax rate of 16%, i.e. a level set by law, which represents the official percentage of a company's profit that must be paid as tax to the state. On the other hand, Poland has a higher statutory rate of 19%.

When analyzing the effective tax rate, the actual tax paid versus accounting profit changes. In Romania, this rate is around 14.4%, lower than the 16% statutory rate.

One reason is the extensive use of deductions and incentives, such as investment exemptions, accelerated depreciation, or tax credits.

Another explanation is inefficient tax collection, including tax evasion or weak administrative capacity that lowers actual revenues.

In Poland's case, the effective tax rate is close to the legal rate, sitting around 19.3%. This suggests that tax rules are enforced more strictly and that deductions or tax breaks have less impact on the tax actually paid. It may also indicate more efficient tax administration and better tax compliance.

Thus, by comparing these two countries, significant differences can be observed in the structure and application of tax systems, which influence budget revenues and the business environment.

Special regimes and tax incentives. A comparative analysis of special tax regimes and incentives for SMEs and investments in innovation in Romania and Poland reveals significant differences in the tax policies applied by the two countries.

In Romania, there is a special tax regime for micro-enterprises, which consists of a reduced tax rate of only 3%. This regime is intended for small businesses, with relatively permissive eligibility conditions — that is, the turnover thresholds and other criteria required to benefit from this reduced rate are easier to meet compared to Poland. This tax measure aims to support the development and growth of small businesses by reducing the tax burden.

In contrast, Poland applies a reduced rate of 9% for micro-enterprises, but with stricter eligibility conditions. Poland also offers a tax model inspired by the Estonian system, which allows certain companies to defer income tax until dividends are distributed. This approach is more flexible, as companies can reinvest profits in their business without paying tax immediately, thus stimulating growth and continuous development.

When it comes to reinvested profits, the differences are notable. Romania offers tax breaks only for profits reinvested in technological equipment, thus limiting the scope of application to investments in new or modernized technologies. This measure encourages the modernization of productive capacities but may restrict options for reinvesting profits in other areas.

Poland, through the Estonian tax deferral model, allows for much more flexible and unlimited reinvestment of profits, without immediate taxation, until the money is distributed to shareholders in the form of dividends. This system stimulates not only investment in equipment, but also in other types of activities or business expansion.

In terms of incentives for research and development (R&D), Romania applies a tax deduction of 50% of eligible expenses, i.e., a reduction of half the amount spent on innovation, technological research, or product development activities. This represents significant support, but it is more modest compared to Poland.

Poland offers much more generous tax deductions, up to 100% for research and development expenses, which means that companies can deduct these costs in full from their tax base. Furthermore, companies located in special economic zones benefit from additional facilities, such as local tax exemptions or other advantages, which further strengthens support for innovative investments and regional development.

Thus, Poland applies a more flexible and generous tax policy to stimulate SMEs and innovation, while Romania has a more restrictive regime, but one that still offers support through reduced rates and specific deductions.

Tax collection efficiency and evasion. A comparative analysis of tax collection efficiency in Romania and Poland reveals significant differences in the ability of the two tax systems to ensure the correct and complete payment of income taxes. A relevant indicator in this regard is the tax gap, i.e., the estimated difference between the tax that should theoretically be paid based on income and the tax collected.

In Romania, this tax gap is estimated at around 25%, which means that a quarter of the taxes that should ideally be collected do not reach the state budget. This indicates a significant proportion of undeclared or under-declared profits, suggesting the presence of high tax evasion, but also possible deficiencies in tax administration.

On the other hand, in Poland, the tax gap is much smaller, at around 15%. This means that a smaller proportion of taxes owed remain uncollected, indicating a more efficient tax system, with higher tax compliance by companies and more rigorous collection by the authorities.

An important aspect that emerges from the analysis of the data is the close link between the level of digitization of the tax administration and its ability to collect taxes efficiently. Poland appears to be more advanced in this area, benefiting from high-performance computerized systems that allow for more accurate monitoring of revenues and better management of tax data. This facilitates the identification of discrepancies, reduces bureaucracy, and limits the possibilities for evasion.

In addition, differences were observed in the way tax reporting and compliance are handled between the two countries, which are reflected in the differences between effective and statutory tax rates. In Romania, the gap between the effective and statutory rates suggests underreporting of

profits or extensive use of deductions, while in Poland these rates are almost equal, indicating stricter compliance.

Also, the structure of tax revenues collected from corporate income tax varies, which may reflect differences in the underground economy, the tax policy applied, or the collection and control capacity of tax administrations. In conclusion, the efficiency of tax collection is influenced both by the technologies used and by the level of voluntary compliance and administrative measures implemented in each country.

The impact of taxation on investment. An analysis of economic indicators reveals a complex relationship between the level of taxation and the volume of foreign direct investment (FDI) in Romania and Poland. Although Romania applies a lower statutory corporate income tax rate (16%) than Poland (19%), this favorable difference has not been reflected in attracting a higher volume of FDI relative to gross domestic product (GDP).

Data from 2023 show that Romania recorded a level of foreign direct investment of only 2.48% of GDP, while Poland reached a significantly higher level of 4.24% of GDP. This indicates that reducing the tax rate alone is not sufficient to significantly stimulate foreign investment.

This observation indicates that fiscal policy is only one of several factors influencing foreign investors' decisions. Firstly, predictability and stability of fiscal rules are crucial—investors favor environments with clear, consistent policies that reduce legislative risk. Secondly, economic and political stability shapes investor confidence, especially for long-term projects. Thirdly, the quality of infrastructure, transport, energy, and communications—is vital for operational efficiency. Lastly, strong integration in global production chains increases a country's attractiveness by facilitating trade and logistics.

To assess these aspects, the analysis also included international economic attractiveness indicators. These showed that Poland scores better in terms of conditions for international investment, reflecting a business environment that is perceived as safer and more friendly to foreign investors.

In contrast, Romania excels in indicators related to the domestic economy, such as domestic consumption or local market potential, but these do not appear to be attractive enough to offset the factors limiting FDI inflows.

In conclusion, to increase the volume of foreign direct investment, Romania should go beyond simply reducing tax rates and address issues related to legislative predictability, infrastructure, and macroeconomic stability to create a favorable and internationally competitive overall framework.

Evolution of budget revenues from corporate income tax. An analysis of the evolution of revenues collected from corporate income tax between 2020 and 2024 provides an important perspective on the fiscal performance and administrative capacity of Romania and Poland.

In Romania's case, revenues from this tax have grown steadily and significantly over the five years analyzed. Thus, the amount collected increased from €3,299 million in 2020 to €7,218 million in 2024, almost doubling. This increase reflects not only more robust economic activity, but also an improvement in the collection capacity of the tax authorities.

During the same period, Poland recorded a somewhat more volatile evolution of corporate income tax revenues, peaking in 2022, followed by a slight decline, but ending 2024 at a level of €13,239 million, i.e. almost double that of Romania in nominal terms. This fluctuation may reflect external economic factors, adjusted fiscal policies, or the effects of the pandemic and other economic shocks on the business environment.

A key indicator for comparing the two countries is the share of corporate income tax revenue in GDP. Here, Romania has seen a notable upward trend, rising from 1.51% of GDP in 2020 to 2.03% in 2024. This increase has enabled Romania to surpass Poland, which recorded a share of 1.79% in 2024. This result suggests that relative to the size of its economy, Romania has become more efficient in collecting corporate income tax.

This improvement in Romania's fiscal performance can be attributed to several factors, including recent tax reforms aimed at simplifying legislation and reducing tax evasion; improved tax administration through digitization, more effective controls, and increased capacity to monitor taxpayers; economic growth and increased corporate profitability, which have generated a larger tax base. On the other hand, Poland's slightly fluctuating performance indicates that, although nominal revenues are higher in relative terms in the short term, they may be influenced by external

factors or fiscal policies adapted to fluctuating economic conditions. In conclusion, the data suggest that Romania has made significant progress in increasing the efficiency of corporate income tax collection, which may contribute to better support for public finances and greater fiscal stability in the medium and long term.

Alignment with European trends. The study included an analysis of how Romania and Poland are adapting to the fiscal changes and requirements imposed at the European Union (EU) level, reflected in major initiatives such as the BEFIT (Business in Europe: Framework for Income Taxation) proposal and the implementation of the OECD's Pillar II on global minimum taxation.

In terms of compliance with the internationally established minimum tax threshold, Romania has already managed to align itself with the requirement for a minimum effective tax rate of 15%. This indicates that Romanian tax legislation and practices are compatible with the new international standards, which is crucial for maintaining competitiveness and avoiding the risks of tax dumping.

Poland, although not yet fully meeting this minimum threshold, is in an advanced process of adaptation and is rapidly approaching compliance. This reveals a growing political will and administrative capacity to respond to the challenges posed by tax harmonization at European and global level.

Beyond meeting the minimum tax threshold, both Romania and Poland must advance in two key areas shaping the future of European taxation. First, sustainable taxation is essential. The EU encourages integrating environmental criteria into tax policy—through incentives for green investments or eco-friendly companies. Aligning with these standards is vital for accessing EU funds and meeting the goals of the European Green Deal. Second, digitalization of tax administration is crucial. This includes deploying advanced IT systems, using AI in audits, and enabling electronic reporting to improve efficiency, reduce evasion, and enhance transparency.

The comparative analysis indicated that Poland is more advanced in terms of institutional readiness and capacity to integrate new European policies. Poland has invested significantly in the digitization of tax administration and the implementation of "green" tax incentives, creating a tax environment more adapted to new European trends.

In contrast, Romania, although making notable progress, needs to intensify its efforts in these areas in order not to fall behind its European partners. This involves both legislative reforms and investments in technology and training for tax personnel.

In conclusion, alignment with European trends is a strategic factor for both countries, being essential for economic competitiveness, attracting investment, and ensuring sustainable public financing in the long term.

5. Conclusions

This paper aims to conduct a comparative analysis between the profit taxation systems in Romania and Poland, with the goal of highlighting the strengths, weaknesses, and fiscal and economic implications of these regimes in the current European context. The research focused on both the legislative and institutional dimensions, as well as the economic impact of fiscal policies on the business environment and foreign direct investment.

Romania – an attractive tax system in theory, but limited in practice. Romania stands out with a relatively low statutory tax rate (16%), below the European Union average, which positions it as a formally competitive tax jurisdiction. In addition, the regime applicable to micro-enterprises (3%) is one of the most favorable in Central and Eastern Europe. These elements should constitute significant advantages for attracting investment and supporting entrepreneurial development.

However, detailed analysis has shown that the efficiency of the Romanian tax system is diminished by several factors: the effective tax rate is below the legal level, tax evasion is high (approximately 25%), and the administrative capacity for collection remains low. In addition, tax incentives for investment and innovation are limited in their applicability, poorly promoted, and often difficult to access due to bureaucracy and legislative uncertainties.

This contrast between formal attractiveness and actual performance highlights a few systemic dysfunctions that affect the functioning of taxation as an instrument of economic development.

Poland – a model of balance between fiscal discipline and innovation stimulation. Poland applies a higher statutory tax rate (19%) but manages to transform it into an effective rate close to 19.3%, which indicates high collection efficiency, better tax compliance, and a strong institutional culture.

The Polish model stands out using modern and coherent instruments to stimulate investment: the application of the Estonian model for profit reinvestment, substantial tax deductions for research and development (up to 100%), and an extensive network of special economic zones (PIZ), integrated into regional development and innovation strategies. These measures are supported by digitized tax administration, legislative stability, and close collaboration between the state and the private sector.

Thus, although taxation is nominally more severe, Poland offers a more predictable environment, geared towards innovation and sustainable growth, which is reflected in its superior performance in attracting foreign direct investment and regional development.

Impact on investment: taxation matters, but it is not enough. One of the most important conclusions of the research is that the level of corporate income tax, although relevant, is not the only determining factor for investment decisions. Poland, despite its higher tax rate, consistently attracted a higher share of FDI in GDP than Romania during the period analyzed (2020–2023). This highlights that investment attractiveness also depends on other factors: the stability of the legislative framework, the quality of infrastructure, the efficiency of tax administration, the predictability of economic policies, and integration into European production and research networks.

Romania, despite a formally attractive tax regime, has failed to capitalize on this advantage in terms of comparable investment performance. This gap suggests the need for structural reforms to transform fiscal potential into concrete economic impact.

Romania – strategic directions for improvement. Based on the Polish model and best practices at the European level, Romania can reform its tax system to make it more efficient and sustainable. Such a transformation would not only improve revenue collection but also stimulate economic growth, innovation, and long-term competitiveness.

One of the key recommendations is the adoption of an optional Estonian tax regime for small and medium-sized enterprises (SMEs). This model allows companies to defer the payment of corporate tax until profits are distributed, encouraging the reinvestment of earnings and the capitalization of businesses during their growth phases. It offers a simple and development-friendly alternative to traditional taxation.

Another important area of reform is the expansion and simplification of fiscal incentives for research and development (R&D). Romania should increase the tax deductions available for eligible R&D expenditures and establish a clear, predictable framework for the validation of such projects. This would provide greater support to innovation-driven companies and encourage private-sector investment in R&D.

A cornerstone of a modern tax system is the full digitization of the tax administration (ANAF). Priority should be given to implementing automatic data reporting, advanced risk analysis, and seamless interoperability between databases. These tools can significantly reduce tax evasion, improve efficiency in tax collection, and allow for more targeted audits and taxpayer services.

Enhancing voluntary tax compliance is also crucial. This can be achieved through better tax education, increased legislative stability, and targeted incentives for compliant taxpayers. Building trust in the tax system and reducing uncertainty will encourage businesses and individuals to fulfill their fiscal obligations more consistently.

Finally, it is essential to align tax incentives with industrial and educational policies. Romania should use its fiscal tools strategically to attract investment in key sectors such as technology, green energy, and digital transformation. This integrated approach can support the development of a knowledge-based, sustainable economy.

Altogether, these measures can help Romania increase budget revenues in a sustainable manner, without raising the overall tax burden. Instead of acting as a constraint, the tax system can become a true engine of development, aligned with the country's broader economic and social goals.

Tax harmonization – an inevitable direction. In the context of European integration and the transition to a sustainable economy, Romania and Poland will have to adapt to new European tax regulations, such as BEFIT, OECD Pillar II, or green taxonomy. Romania is in a relatively favorable position, already having a rate close to the minimum threshold of 15% and being involved in tax digitization projects (e-Invoice, SAF-T). However, the implementation of these reforms will require institutional consolidation, modernization of tax procedures, and constant dialogue with the private sector.

A comparison of the profit taxation systems in Romania and Poland reveals two different models of tax administration: Romania, with an approach geared towards low rates and specific incentives, but with limited efficiency, and Poland, with a more rigorous system, but well integrated and effective in attracting investment and supporting innovation.

For Romania, transforming the tax system into a strategic development tool does not necessarily mean increasing the tax burden, but rather increasing the efficiency of collection, simplifying regulations, digitizing administration, and better integrating taxation with national and European economic objectives.

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Public Finance and the Green Transition: Romania's Strategic Path in Implementing the European Green Deal

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Abstract

This paper investigates the role of public finances in advancing Romania's green transition, in line with the commitments undertaken through the European Green Deal.

The research aims to demonstrate how fiscal policies, and the strategic use of European funds, contribute to the development of a sustainable and competitive national economy.

The overall objective is to identify and evaluate the main national and European financial instruments dedicated to supporting the green economy. To achieve this, three specific objectives are pursued: analyzing the relevant legislative framework, examining the sources of funding available for the period 2021–2030, and identifying institutional challenges, together with possible solutions. The case study on the Ministry of European Investments and Projects provides a concrete perspective on the absorption of funds for the green transition. The paper draws useful conclusions for public decision-makers, highlighting the need for integrated strategic planning and the involvement of private capital in the sustainable transformation process.

Key words: green transition, European Green Deal, public finances, European funds, sustainable economy

J.E.L. Classification: H50, Q01, Q58, O13, E62

1. Introduction

Climate change has emerged as a critical challenge for the global community, driving governments and international bodies to take decisive action to curb environmental damage. This shared concern has spurred the creation of structured strategies, binding agreements, and cooperative initiatives focused on cutting greenhouse gas emissions, safeguarding ecosystems, and advancing sustainable growth. The growing occurrence of extreme climatic events, the steady rise in sea levels, and the rapid decline in biodiversity have heightened the demand for urgent measures. Consequently, the issue has gained prominence on the international policy agenda, underscoring the recognition of its profound economic and social consequences. In this context, the European Union has set forth the European Green Deal, outlining a pathway toward achieving climate neutrality by the year 2050. This comprehensive approach extends beyond environmental targets, envisioning a fundamental shift in Europe's economic and social framework through changes in production, consumption, and resource management. Moving toward a green economy calls for deep transformations across essential sectors, including energy, transportation, agriculture, manufacturing, and infrastructure. Achieving this shift demands substantial financial investment and the effective use of both public and private funding sources. Public authorities play a pivotal role in this process, not only by shaping

Romania, as a member state of the European Union, actively participates in the implementation of the European Green Deal, aligning its national policies with the Union's climate neutrality objectives. This involvement positions Romania within the broader strategic framework of economic and environmental transformation pursued at the European level. Our country has a responsibility to adapt and implement European policies on green transition, in line with national specificities and the needs of Romanian society. In this regard, public finances play a fundamental

role, as they have the capacity to support climate objectives through the strategic allocation of available funds. This support is not limited to national budget allocation but also includes the efficient use of non-reimbursable European funds, attracting private investment, and strengthening institutional capacities for resource management. However, a few structural difficulties persist in Romania that affect the efficiency of the transition process. Among the most important are the low absorption rate of European funds, deficiencies in strategic planning, institutional fragmentation, and budgetary constraints. These obstacles may limit the country's progress in achieving the objectives set at European and international level.

This paper sets out to examine the contribution of public finances to the implementation of the green transition in Romania, concentrating specifically on the institutional role played by the Ministry of European Investments and Projects (MIPE) in the management of European funds earmarked for this strategic objective. The analysis is structured around the mechanisms through which MIPE operationalizes financial instruments that support the objectives of the European Green Deal, focusing on the alignment between national priorities and European funding frameworks. By investigating the processes of fund allocation, project selection, and monitoring procedures, the study seeks to assess the extent to which public financial governance in Romania facilitates the transition toward a climate-resilient and environmentally sustainable economy. Particular attention is given to the coherence of MIPE's interventions with green policy targets, the transparency of financial decision-making, and the institutional capacity to manage complex funding structures under the NextGenerationEU and other multiannual financial instruments. The paper aims to provide an evidence-based account of the interaction between European funding mechanisms and domestic public finance strategies, highlighting how MIPE functions as a key actor in translating supranational environmental commitments into concrete investment programs at the national level, within the broader architecture of the green transition. The overall objective of the research is to evaluate the financial mechanisms used to achieve the climate targets assumed by Romania in the context of its commitments to the European Union. This analysis addresses several specific objectives, including investigating the regulatory framework governing the green transition, identifying the main sources of funding available for the implementation of green projects, and highlighting the challenges encountered in the process of absorbing and using funds. At the same time, the paper analyzes the opportunities that exist in the context of new European and international financial instruments.

Through this approach, the research aims to provide an integrated perspective on the relationship between public finances and economic and environmental sustainability. The emphasis is on the importance of effective governance, strong inter-institutional collaboration, and a coherent strategic vision as essential factors in facilitating the transition to a green and resilient economy. Finally, the paper formulates concrete recommendations aimed at enhancing the institutional and financial framework that supports the implementation of the green transition in Romania, thereby contributing to the consolidation of national efforts in addressing the challenges posed by climate change and aligning with European sustainability objectives.

2. Literature review

The shift toward a sustainable economy has emerged as a foundational theme in contemporary economic research, driven by the accelerating impact of climate change, the progressive depletion of natural resources, and the escalating stress placed on global ecosystems. Over the past twenty years, scholarly interest in this field has expanded considerably, underpinned by a growing scientific consensus regarding the anthropogenic origins of climate disturbances and reinforced by the establishment of shared international commitments, most notably by the 2015 Paris Agreement. Within this evolving intellectual and policy landscape, the European Green Deal introduced by the European Commission in 2019 has assumed a central role in both academic inquiry and strategic public discourse. Recognized for its scope and ambition, the Green Deal is increasingly examined as a transformative framework aimed at reshaping the European Union's economic model in alignment with long-term sustainability objectives. It integrates climate neutrality targets, circular economy principles, and social equity considerations into a unified strategy for structural change. As such, the European Green Deal has become a critical object of study, not only as a policy

instrument but also as a conceptual cornerstone in the literature addressing the interface between environmental imperatives and economic systems (European Commission, 2019).

The academic literature highlights that the primary objective set out by the European Green Deal consists in reaching climate neutrality by 2050, a target that demands a profound transformation of both economic structures and societal models. Achieving this objective involves reconfiguring production systems, energy use, mobility, agriculture, and consumption habits. It also requires integrated policy frameworks, cross-sectoral coordination, and sustained public and private investment. The literature emphasizes that climate neutrality is not merely a technological challenge, but a structural shift toward sustainability. Therefore, the European Green Deal is framed as a long-term strategy that redefines development pathways within the European Union.

This transformation is articulated through a set of interconnected strategic directions that include the decarbonisation of the energy system, aimed at phasing out fossil fuel dependency and increasing the share of renewable energy sources. It also involves the electrification of transport, with a focus on reducing emissions in mobility through the adoption of clean technologies and infrastructure. The transition to sustainable agricultural practices represents another critical dimension, promoting environmentally responsible food systems and resource efficiency. Industrial modernisation is equally emphasized, targeting the deployment of green technologies, digital innovation, and circular economy principles to reduce the environmental footprint of production. Finally, the protection and restoration of biodiversity are presented as integral components of the Green Deal, reinforcing the link between ecological stability and long-term economic resilience. These pillars form the foundation of a strategic vision designed to realign the European Union's development trajectory with climate objectives, positioning sustainability as the core principle of future growth and integration (European Commission, 2020). The strategy involves mobilizing more than €1 trillion in public and private investment over the next ten years, which implies an acute need to reform the European financial and budgetary framework. The European Commission (2020) estimates that, to achieve the targets set, additional annual investments of at least EUR 260 billion are needed.

In theory, one of the most influential works that shaped the economic discourse around climate change is the report by Nicholas Stern (2007). It argues that inaction in the face of climate change could generate economic losses of up to 20% of global GDP, while the cost of preventive measures would be less than 1% of GDP. This powerful economic argument has been taken up in numerous subsequent works advocating active state intervention to correct market failures associated with the negative externalities of carbon emissions. Ekins et al. (2019) reinforce this direction, arguing that public policies must create a framework of predictability and incentives for the private sector, particularly through green subsidies, green taxation, and strategic public investment.

De Grauwe (2020) emphasizes, from a macroeconomic perspective, the essential role of public finances in managing the green transition. He argues that, in the absence of substantial state involvement, the market will not be able to generate the necessary structural changes. Moreover, he draws attention to the fact that fiscal and monetary policies must become proactive in supporting environmental objectives through dedicated budget allocations, green industrial policies, and the integration of climate risks into national and European financial systems.

Recent international literature has begun to pay increased attention to innovative financial instruments for the green transition. Flammer (2021), for example, highlights the potential of green bonds to stimulate investment in sustainable infrastructure, reduce the cost of capital for green companies, and increase transparency in the use of funds for green projects. Studies show that green bonds are not only a tool for attracting capital, but also a signaling mechanism for investors, with positive effects on companies' reputation and performance (Flammer, 2021). Along similar lines, Monnin (2018) analyzes how central banks' monetary policies can support the green transition through preferential refinancing operations for green assets and the integration of climate risks into the assessment of bank portfolios.

In Romanian literature, studies dedicated to financing the green transition are less numerous but growing. An important contribution is made by the analyses of the Ministry of European Investments and Projects (MIPE), which provides a detailed picture of the main sources of financing available for the green transition, through the National Recovery and Resilience Plan (PNRR), the Modernization Fund, and InvestEU. According to MIPE (2023), Romania has access

to significant financial resources, but the absorption rate of funds remains below potential due to institutional challenges, lack of administrative capacity, and legislative instability. These findings are also confirmed by the National Bank of Romania (2022), which draws attention to the low level of financial inclusion, the shortage of mature projects, and the lack of a predictable framework for sustainable investments.

Another emerging subfield in the literature is that of just transition, which aims to ensure social equity in the process of ecological transformation. The European Commission (2020) promotes this concept through the Just Transition Mechanism, dedicated to supporting regions and workers affected by decarbonization. In the Romanian context, the concept has been analyzed by Georgescu (2021), who argues for the importance of active policies for professional retraining, regional development, and economic support for mono-industrial counties. Popescu and Iancu (2022) complement this analysis by pointing out the lack of a coherent institutional mechanism to enable the effective implementation of funds earmarked for a just transition, particularly in mining areas affected by mine closures.

In addition to these contributions, national and international literature increasingly highlights the need for an effective governance framework for managing green transition funds. The OECD (2021) emphasizes the importance of inter-institutional coordination, transparency in resource allocation, and the involvement of local communities in the decision-making process. In Romania, such recommendations are essential, given the fragmented nature of climate policies and recurring administrative difficulties (MIPE, 2024).

Furthermore, the issue of mobilizing private capital is analyzed in numerous recent studies, which indicate that public finances, although fundamental, cannot fully cover the financial needs of the green transition. Thus, public-private partnerships, guarantee instruments, venture capital funds, and blended finance initiatives are increasingly present in the literature (World Bank, 2022). These mechanisms can ensure the scaling up of green projects and reduce the risks associated with investments in innovative technologies, but they require clear regulation and robust governance to be effective.

In conclusion, the literature confirms the complex and multidimensional nature of the green transition, which involves not only environmental policies but also structural reforms in the economy, governance systems, and financial architecture. Public finances are seen as an indispensable catalyst in this process, both through the allocation of budgetary resources and through the creation of a stable and predictable framework that encourages the mobilization of private capital. In the case of Romania, the literature identifies both significant opportunities and systemic challenges, highlighting the need for a coherent strategic vision, institutional capacity building, and effective governance to enable the full utilization of available resources for the transition to a green, sustainable, and equitable economy.

3. Research methodology

The research presented in this paper is conducted through a qualitative, descriptive-analytical approach that investigates the contribution of public finance to the green transition in Romania, viewed through the lens of the European Green Deal's implementation. The study relies on a methodology that combines documentary analysis with the interpretation of relevant statistical data, aiming to capture the dynamics and mechanisms through which public financial instruments facilitate environmental sustainability objectives. Central to the investigation is a case study focusing on the Ministry of Investments and European Projects (MIPE), which plays a pivotal role in mobilizing financial resources and coordinating funding programs aligned with green priorities. The research framework integrates institutional documents, policy reports, budgetary data, and programmatic evaluations to assess the extent to which Romania's public finance system supports the strategic shift toward a low-carbon, resource-efficient economy. By analyzing the financial flows, allocation criteria, and policy coherence within MIPE's portfolio, the study identifies both enablers and constraints in the national governance of green investments. This approach allows for a nuanced understanding of how fiscal instruments and public investment planning intersect with environmental policy objectives, offering insights into the effectiveness of Romania's institutional response to the European Green Deal framework.

To outline the theoretical and normative framework, a systematic review of the specialized literature from academic sources, official documents of the European Commission, reports of the National Bank of Romania, MIPE, as well as analyses carried out by international organizations involved in sustainable financing was conducted. These sources were used to define key concepts such as green transition, sustainable finance, public investment, and climate neutrality.

The applied component of the research focuses on a case study of the activity of the Ministry of European Investments and Projects in the period 2021–2024. At this stage, the main sources of European funding (PNRR, InvestEU, Modernization Fund, Just Transition Fund), the allocation and spending of funds, the degree of absorption, and the estimated impact on GDP and the labor market were analyzed.

For the quantitative part, secondary data from official sources tables and graphs provided by MIPE and the European Commission were used, which were processed and interpreted economically. The absorption rate, the volume of green investments relative to GDP, and allocations by area (energy, transport, energy efficiency) were analyzed to identify dysfunctions and good practices.

The limitations of the methodology lie in its dependence on publicly available data and the lack of primary survey. However, the integrated qualitative-quantitative approach provides a solid basis for formulating conclusions and recommendations on the effectiveness of green transition financing in Romania.

4. Findings

The research results confirm that Romania is at a critical stage of economic and social transformation, marked by the integration of European climate ambitions into national development strategies. The green transition, defined in the European Green Deal as the process of transforming the European economy into a sustainable and climate-neutral one by 2050 (European Commission, 2019), involves a systemic change that transcends traditional sectoral boundaries. In Romania, this process is accelerated by European financing and conditionality mechanisms but remains strongly conditioned by the internal capacity for absorption, implementation, and adaptation to new institutional and economic paradigms.

One of the central conclusions of the research is that the financing architecture for the green transition in Romania is both complex and vulnerable. In theory, Romania benefits from a favorable financial framework, with access to a wide range of European instruments, including the Recovery and Resilience Facility (PNRR), the Modernization Fund, InvestEU, Cohesion Funds, and the Social Climate Fund. However, the application of these instruments is marked by a few structural limitations: low level of digitization in public administration, shortage of qualified personnel, cumbersome bureaucratic procedures, and lack of a coherent strategic framework for integrating climate objectives into public budgets (MIPE, 2023; BNR, 2022).

Excessive reliance on non-repayable grants to the detriment of market instruments reflects institutional reluctance to take financial risks and a reduced capacity to mobilize private capital. While green bonds, sovereign guarantees, and risk-sharing schemes have become standard instruments in developed economies for financing sustainable projects (Flammer, 2021; Monnin, 2018), in Romania they are used marginally. Even though the Romanian state has taken steps to issue sovereign green bonds as part of its debt instrument diversification plan (MIPE, 2024), the institutional infrastructure that would enable a functional financial ecosystem in this regard is still in its infancy. This situation leads to predominantly top-down financing, with the state playing the leading role and the market remaining a peripheral actor.

Another major aspect highlighted is the strategic role of the Ministry of Investments and European Projects (MIPE), which acts as the main coordination center for European funds earmarked for the green transition. Its functions are not limited to attracting and distributing resources, but also include developing funding guidelines, monitoring project implementation, and reporting regularly to the European Commission. According to official reports, MIPE's administrative capacity has increased significantly in recent years, with the absorption rate of European funds rising from around 14% in 2021 to a projected 80% in 2024 (MIPE, 2024). This development indicates progressive institutional maturation and better adaptation to the 2021–2027

financial cycle. However, the progress made does not eliminate persistent structural vulnerabilities, such as the fragmentation of responsibilities between institutions, the lack of specialized staff at the local level, and legislative constraints on public procurement.

The thematic distribution of funds allocated to the green transition in Romania reflects a strategic orientation aligned with European priorities, but at the same time suggests certain internal imbalances. Thus, the analysis of budget allocations indicates a concentration of resources in areas such as renewable energy (32%), sustainable transport (22%), and energy efficiency (18%). Funds for research and innovation (17%) indicate an openness to supporting emerging technologies, while allocations for the protection of vulnerable groups (4%) indicate limited concern for the social dimension of the transition (MIPE, 2023). Despite the rhetoric about a "just transition," the low proportion of funds earmarked to support groups affected by decarbonization such as workers in polluting industries or low-income households highlights the underrepresentation of these groups in decision-making and budgeting processes.

From an ecological convergence perspective, Romania is below the European average in terms of green investments, both as a share of GDP and in per capita terms. Available data show that Romania allocates approximately 1.9% of GDP to green investments, compared to the European Union average of 2.6%, Germany (3.1%) or France (2.8%) (Eurostat, 2024). In absolute terms, per capita spending on green projects is around EUR 410, compared to EUR 850 in Germany and the EU average of EUR 670. This difference reflects not only the gap in economic development, but also the different prioritization of the climate agenda in the national budget architecture. Despite extensive access to European funds, the low level of financial execution suggests either a lack of administrative capacity or insufficient political will to make sustainability a cross-cutting objective of public policies.

A specific focus of the research is the territorial analysis of interventions under the Just Transition Program. It targets six regions affected by the decarbonization process Gorj, Hunedoara, Dolj, Galați, Prahova, and Mureș characterized by their historical dependence on extractive and energy-intensive industries. The total budget of over €2.5 billion aims to support the structural transformation of these regions through retraining projects, SME development, green infrastructure, and investments in education and innovation (European Commission, 2023). Pilot projects, such as the construction of photovoltaic parks in Gorj or vocational training centers in Hunedoara, offer evidence of potential economic revitalization. However, the lack of an integrated approach combining economic, social, and cultural interventions raises risks regarding the sustainability of these transformations. Without the active involvement of local communities and a coherent vision for regional development, the transition risks being perceived as a source of uncertainty rather than an opportunity for regeneration.

The research also highlighted a direct link between the level of integration of green financing into public policies and the effectiveness of governance. Member States that have managed to coherently align strategic planning, climate objectives, and budget allocations such as the Netherlands, Sweden, and Germany demonstrate the ability to use European funds in an efficient and impact-oriented manner (Ekins et al., 2019; De Grauwe, 2020). In Romania, this process is ongoing, but there are still inconsistencies between environmental, fiscal, and industrial policies. For example, while investments in renewable energy are being promoted, indirect forms of support for fossil fuels continue to exist, such as subsidies for thermal power plants or the lack of environmental taxation. These inconsistencies contravene the principle of "do no significant harm" and undermine the credibility of transition programs in the eyes of investors and the public (European Commission, 2020).

Finally, a key conclusion of the study is that the success of the green transition cannot be measured exclusively in quantitative terms funds raised, projects approved, kilowatts installed—but must be analyzed from the perspective of systemic impact: improving quality of life, strengthening social cohesion, and enhancing economic resilience. To achieve these objectives, a paradigm shift in governance is needed: from a reactive model based on compliance and reporting to a proactive one focused on results, partnerships, and innovation. The involvement of the private sector, civil society, and local authorities must become a fundamental component of financing mechanisms. At the same time, a new administrative culture is needed, focused on transparency, accountability, and execution capacity.

5. Conclusions

The study highlights that Romania is at a critical juncture in its transition to a green economy, facing both major structural challenges and unprecedented financial opportunities. The European funds available for the period 2021–2030, those allocated through the PNRR, the Modernization Fund, InvestEU, or the Just Transition Program, are the central pillars of national decarbonization and modernization efforts. However, the mere existence of these resources does not guarantee the success of the transition. The efficient use of funds depends directly on the quality of governance, institutional absorption capacity, and the strategic commitment of decision-makers.

A key finding of the analysis is that the Ministry of Investment and European Projects (MIPE) plays a key role in the institutional architecture of the green transition. By managing European funds and promoting an integrated approach, MIPE has managed to accelerate the absorption process and support structural reforms in strategic areas such as sustainable transport, energy efficiency, and renewable energy. This development is particularly relevant in the context of the European climate neutrality targets for 2050 and the need to align national policies with European sustainability standards.

However, the data analyzed indicates significant disparities between funding potential and the actual implementation of projects. Despite a gradual improvement in the absorption rate, administrative bottlenecks, delays in the preparation of technical documentation, and insufficient strategic planning capacity at the local level persist. These obstacles may reduce the long-term impact of investments and affect Romania's ability to fully access the funds available under the current multiannual financial framework.

From a socio-economic perspective, the green transition generates not only opportunities for sustainable development but also risks related to social exclusion and regional polarization. Investments in regions affected by decarbonization, supported by the Just Transition Program, are a partial response to these risks, but require better integration of the social dimension into national climate policies. Support for vulnerable households and workforce retraining are essential to ensure a just and inclusive transition.

In conclusion, Romania has all the financial and strategic prerequisites to move towards a green economy, but the success of this process depends on a profound transformation of the governance paradigm. Administrative reform is needed to reduce bureaucracy, improve inter-institutional coordination, and increase the transparency of the decision-making process. It is also essential to actively involve the private sector, local authorities, and civil society in defining and implementing green solutions. The green transition represents more than a technical or financial objective; it constitutes a systemic transformation requiring coordinated adaptations across all dimensions of economic and social life, including production models, consumption patterns, institutional frameworks, and behavioral norms, thereby reshaping the foundations of development toward long-term environmental and societal sustainability.

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Theoretical and Practical Approaches on the Relation between Taxation and Indicators of Inequality

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Abstract

The aim of the paper is to signalize different aspects that stand out from the theoretical review concerning the influence of different taxes on the inequality (Gini coefficient) and poverty and those from regression models aimed to observe the degree of influence of each independent variable on the dependent variable - Gini coefficient (inequality) and Poverty Rate (Persons at risk of poverty or social exclusion). Conclusions emphasize on the final results of the research drawn from theoretical review on the topic studied and the econometric regression analysis. The methodology used was: researching the scientific literature in the field, synthesize and giving the own author's interpretation of the ideas and ending in a new research achieved in the field of study; collecting statistical data and the analyses of the situations derived from the econometric regression models. The study was achieved for Member States of European Union (EU 27), on 2014-2022 period.

Key words: taxes, income inequality (Gini coefficient), poverty rate, impact, regression models.

J.E.L. classification: C20, D63, H71, I30, I32

1. Introduction

Increasing inequality gained concernment during the last decades, considering to be influenced by globalization. Luebker (2011) There is a large interest on the implication of taxation systems in tackling inequality. Direct taxes and indirect taxes impact on inequality and they are subject of many policies and strategies at governmental level, in direction to reduce disparities, limit as much as possible, the risk of poverty, social exclusion, supporting inclusive growth. A fair distribution of taxes is an aspect that countries take into consideration, in their step to meet the need for increased revenues. (OECD 2024).

Efforts to diminish poverty in developing countries are trammelled by income inequality, considered as an obstacle to economic development. Thus, in this purpose the World Bank has outlined initiatives in order to diminish as maximum as possible, the poverty and increasing wealth and living standard of people, by diminishing inequality. (Omar and Inaba, 2020). In this sense, financial inclusion leads to social inclusion, a process through which the poverty and income inequality are combated, by opening ways of progress, for the disadvantaged and marginalized. (Omar and Inaba, 2020).

Inequality is known to be an increasing problem, all over the world, given the influence by different factors: the crisis challenged by Coronavirus, which emphasized the inequality, the digitalization which has increasingly penetrated different areas of activity and influence labour force, development gaps between regions that strengthen inequality. This influence elements and many others calls for efforts at the governmental level, to reduce inequality, through fiscal policies of income redistribution and other types of strategies, so that the risk of poverty, marginalization and social exclusion can be avoided or limited, as much as possible. (Lei, X.-T.; Xu, Q.-Y.; Jin, C.-Z (2022); Nadezhina, O.; Avduevskaia, E. (2021) Azarenko, N.; Kazakov, O.; Kulagina, N.; Rodionov, D. 2020; Rodionov, D.G.; Kudryavtseva, T.J.; Skhvediani, A.E.(2018) ; Rodionov, D.; Zaytsev, A.; Konnikov, E.; Dmitriev, N.; Dubolazova, Y. M (2021); Volodin, A.; Ivanov, M. Djanelidze, M.; Sokolitsyn, A. (2019); Victorova, N.; Rytova, E.; Koroleva, L.; Pokrovskaja,

N.(2020); Belov, A.(2021) Nesterov, I.O.(2021) quoted in Dianov, Koroleva, Pokrovskaja, Victorova and Zaytsev (2022).

2. Theoretical background

Different authors tried to identify different models concerning the impact of taxation.

In their study, authors Sergey Dianov, Lyudmila Koroleva, Natalia Pokrovskaja, Natalia Victorova and Andrey Zaytsev (2022) tried to observe possible models in studying the influence of direct taxation on income inequality, in the economy. They highlighted the assumption proved, that direct taxation has an important impact on inequality, relating to the measure of economic evolution and the specific nature of country's fiscality. They noticed that among different European Union countries, taxes have a different impact on income inequality, depending on the conjuncture of every country taxation reforms. (Dianov, Koroleva, Pokrovskaja, Victorova and Zaytsev, 2022).

Bakar & Pathmanathan (2020) (quoted in Dianov, Koroleva, Pokrovskaja, Victorova and Zaytsev, 2022) used different models to achieve the influence of income indicators on inequality indicators (Gini coefficient).

In their model, Pastor and Pietro (2015) (quoted in Gill, 2016), provide the idea that as tax rates increase, the productivity rise in economy. They developed a model according to which increasing tax rates discourage and remove entrepreneurs with low skills and low resilience for risk, remaining those entrepreneurs which invest in efficient projects which bring them increased returns. In addition to their previous study, Pastor and Veronesi (2015) analysed tax rates on thirty four countries, in the interval 1980 - 2013 and they found a more strengthen relation between tax rates, productivity, and inequality.

Also, Bertotti and Modanese (2016) (quoted in Dianov, Koroleva, Pokrovskaja, Victorova and Zaytsev, 2022) analysed different aspects: the relationship between income inequality and the economic mobility (changes on economic status of people – assessed in income, as a rule – (*Economic mobility*, Wikipedia, https://en.wikipedia.org/wiki/Economic_mobility); the correlation between income inequality (Gini coefficient) and the level of tax evasion, where they researched different types of human behaviour in relation to tax evasion (shadow economy) and their impact on income redistribution. They reached the conclusion that as tax evasion raises, the inequality (Gini coefficient) increases for all population.

Authors Omar and Inaba (2020) achieved a study on the way the financial inclusion influence on diminishing rate of poverty and income inequality in developing countries, developed for the interval of 2004–2016 years. Their paper proves a strengthen observation that financial inclusion is of a substantial influence in diminishing poverty and income inequality in developing nations. The result obtained is valid for developing nations but does not match for individual countries. (Omar and Inaba, 2020).

Park and Mercado (2018) (quoted in Omar and Inaba, 2020) developed a study on the different nations effect of financial inclusion on poverty and income inequality. The results achieved show that a financial inclusion raise is correlated with an increase in economic growth and a reduction of poverty rate. The result proved to be valid just to countries with increased and middle income.

Duncan and Peter (2012) determined the relationship between progressive taxes on personal income and income inequality (Gini coefficient). The results they obtained show that progressive taxes have an impact of diminishing in income inequality (Gini coefficient).

3. Research methodology

The paper was accomplished by: *researching the scientific literature in the field, synthesize and giving the own author's interpretation of the ideas and ending in a new research achieved in the field of study; collecting statistical data* from the European Commission, DG Taxation and Customs Union based on Eurostat data, Data on Taxation Trends; Eurostat database, Eurostat: Gini Coefficient of equivalised disposable income by age; Eurostat: Persons at risk of poverty or social exclusion by age and sex and the analysis of the situations derived from the econometric regression

models. The analysis was achieved for Member States of European Union (EU 27), for the period 2014-2022.

Each regression model ends with conclusions drawn on the aspects derived from the values taken by the coefficients, probability, coefficient of determination R^2 which gives different influence and correlations between the independent and dependent variables.

The paper ends with conclusions which highlight the final results of the research.

4. Findings

4.1. Simple regressions between variations in taxation and indicators of inequality

In the model below, observation of the correlation between variations in taxation and indicators of inequality is attempted. The aim is to observe the level of influence of each independent variable on the dependent variable - the Gini coefficient (inequality) and Poverty Rate (Persons at risk of poverty or social exclusion).

"Income inequality is the differences in how income is distributed among the population". (OECD *Income inequality Indicator, Income inequality* (disposable income, Gini coefficient <https://www.oecd.org/en/data/indicators/income-inequality.html>) Gini coefficient is an index of measuring income inequality. (OECD *Income inequality Indicator, Income inequality (disposable income) Gini coefficient* <https://www.oecd.org/en/data/indicators/income-inequality.html>).

"Poverty rate is the ratio of the population whose income falls below the poverty line" (OECD, *Poverty rate Indicator*, <https://www.oecd.org/en/data/indicators/poverty-rate.html>).

For this analysis, simple regression models were used through *the method of the smallest squares (Least Squares)* – a method of estimating parameters, achieved in each individual model. (Wikipedia, *Least squares*, https://en.wikipedia.org/wiki/Least_squares).

Dependent variables: Gini coefficient (inequality), Persons at risk of poverty or social exclusion by age and sex,

Independent variables: total taxes (% in GDP); direct taxes (% of GDP); tax revenue (% in GDP); indirect taxes (% in GDP); VAT (% of GDP).

4.2. Models with dependent variables: Gini coefficient (inequality)

MODEL 1 1) COEFGINI = F(IMPTOTALPIB)

Independent variable total taxes (% in GDP) IMPTOTALPIB

The coefficient (-0,27) shows that the independent variable *total taxes* (% in GDP) has a negative influence on the dependent variable, the *Gini coefficient (inequality)*. A 1-unit increase in the independent variable, total taxes is associated with a decrease of 0.27, of the dependent variable, Gini coefficient (inequality), which signifies a positive effect for income inequality (Gini coefficient). This decrease shows that between the independent variable total taxes and the dependent variable Gini coefficient; there is an inversely proportional relation.

Probability $0.0 < 0.05$ shows a *statistically significant influence* of the independent variable, total taxes on the dependent variable, the Gini coefficient (inequality) which means that the tax changes are statistically reflected on the level of inequality.

The coefficient of determination R^2 $0.16 < 0.6$ shows a *weak* link between the independent variable total taxes (% in GDP) and the dependent variable Gini coefficient (inequality). This means that only 16% of the dependent variable Gini coefficient (inequality) is due to the contribution of the independent variable total taxes. (**Table 1, see Annex**)

Conclusion

The model shows a significant influence of independent variable, total taxes, on the dependent variable, the Gini coefficient (inequality), the two variables being in inversely proportional relation, the independent variable having a positive effect on the dependent one. 16% of the dependent variable Gini coefficient (inequality) is due to the contribution of the independent variable, total taxes.

MODEL 2 2) COEFGINI = F(IMPDIRLPB, IMPINDIRPB)

Independent variable: direct taxes (% in GDP) (IMPDIRPB)

The coefficient of the independent variable (-0,22) shows that the independent variable *direct taxes* (% in GDP) has a negative influence on the dependent variable, *the Gini coefficient (inequality)*. A 1-unit increase in the independent variable direct taxes is associated with a decrease of 0.22, of the dependent variable Gini coefficient (inequality), which signifies a positive effect for income inequality. This decrease shows that between the independent variable direct taxes and the dependent variable, Gini coefficient, there is an inversely proportional relation.

Probability $0.0 < 0,05$ shows a statistically significant influence of the independent variable, direct taxes on the dependent variable, the Gini coefficient (inequality), which means that the changes in taxation are statistically reflected on the level of inequality.

The coefficient of determination R^2 $0.08 < 0.6$ shows a weak link between the independent variable direct taxes (% in GDP) and the dependent one, Gini coefficient (inequality). This means that 8% of the dependent variable Gini coefficient (inequality) is due to the contribution of the independent variable direct taxes. (Table 2, see Annex)

Conclusion

The independent variable direct tax has a significant influence on the dependent variable, Gini coefficient (inequality), the effect being positive, of diminishing the income inequality, with the mention that only 8% of the dependent variable Gini coefficient (inequality) is due to the contribution of the independent variable.

Independent variable: indirect taxes (% in GDP) (IMPINIDIRPB)

The coefficient 0.04 shows that the independent variable indirect taxes (% in GDP) has a positive influence on the dependent variable, Gini coefficient (inequality). An increase of 1 unit of the independent variable, indirect taxes is associated with an increase with 0.04, of the dependent variable, Gini coefficient (inequality), which signifies a negative effect for income inequality. This increase shows that between the independent variable, indirect taxes and the dependent variable Gini coefficient, there is a directly proportional relation.

Probability $0,61 > 0,05$ shows a *statistically insignificant influence* of the independent variable (indirect taxes) on the dependent variable, Gini coefficient (inequality).

The coefficient of determination R^2 $0,08 < 0,6$ shows a *weak* link between the independent variable indirect taxes (% in GDP) and the dependent one, the Gini coefficient (inequality). This means that only 8% of the dependent variable Gini coefficient (inequality) is due to the contribution of the independent variable indirect taxes. (Table 2, see Annex)

Conclusions *The model shows an insignificant influence of the independent variable, indirect taxes on the dependent variable, Gini coefficient (inequality), the effect on it being negative, of increasing income inequality; between the two variables there is a directly proportional relationship. Only 8% of the dependent variable, Gini coefficient (inequality) is due to the contribution of the independent variable, indirect taxes.*

MODEL 3 3) COEFGINI= F(IMPDIRPB, VENITURIPB)

Independent variable: direct taxes (% in GDP) (IMPDIRPB)

The coefficient (- 0.18) shows that the independent variable, direct taxes (% in GDP) has a negative influence on the dependent variable, Gini coefficient (inequality). A 1-unit increase in the independent variable, direct taxes is associated with a decrease of 0.18, of the dependent variable, Gini coefficient (inequality), which signifies a positive effect for income inequality. This decrease shows that between the independent variable direct taxes and the dependent variable Gini coefficient, there is an inversely proportional relation.

Probability $0,0002 < 0,05$ shows a statistically significant influence of the independent variable, direct taxes, on the dependent variable, Gini coefficient (inequality), which means that the changes in taxation are statistically reflected on the level of inequality.

The coefficient of determination R^2 $0.12 < 0,6$ shows a weak link between the independent variable, direct taxes (% in GDP) and the dependent one, Gini coefficient (inequality). This means that only 12% of the dependent variable Gini coefficient (inequality) is due to the contribution of the independent variable, direct taxes. (Tabel 3, see Annex)

Conclusion *The independent variable direct taxes exert a significant influence on the dependent one (Gini coefficient), its effect, being of diminishing the income inequality (Gini coefficient), between the two variables there is an inversely proportional relation. 12% of the dependent variable, Gini coefficient (inequality) is due to the contribution of the independent variable, direct taxes.*

Independent variable: tax revenues (% in GDP) (VENUURIPB)

Coefficient (- 0.64) shows that the independent variable tax revenues (% in GDP) has a negative influence on the dependent variable, Gini coefficient (inequality). A 1-unit increase in the independent variable, tax revenues is associated with a decrease of 0.64, of the dependent variable, Gini coefficient (inequality), which signifies a positive effect for income inequality. This decrease shows that between the independent variable, tax revenues and the dependent variable, Gini coefficient there is an inversely proportional relation.

Probability $0.02 < 0.05$ shows a statistically significant influence of the independent variable, tax revenues, on the dependent variable, Gini coefficient (inequality), which shows that the changes in taxation are statistically reflected on the level of inequality.

The coefficient of determination $R^2 0.12 < 0.6$ shows a weak link between the independent variable, tax revenues (% in GDP) and the dependent variable, Gini coefficient (inequality). This means that only 12% of the dependent variable Gini coefficient (inequality) is due to the contribution of the independent variable, tax revenues. **(Tabel 3, see Annex)**

Conclusion *The model shows that the independent variable, tax revenues exert a significant influence on the dependent variable, its effect being positive, of diminishing the income inequality (Gini coefficient); between the two variables there is an inversely proportional relation. 12% of the dependent variable, Gini coefficient (inequality) is due to the contribution of the independent variable, tax revenues.*

MODEL 4 4) COEFGINI= F(IMPINDIRPIB, TVAPIB)

Independent variable: indirect taxes (% in GDP) (IMPINIDIRPIB)

Coefficient (- 0.11) shows that the independent variable, indirect taxes (% in GDP) has a negative influence on the dependent variable, Gini coefficient (inequality). A 1-unit increase in the independent variable, indirect taxes is associated with a decrease of 0.11 of the dependent variables, Gini coefficient (inequality), which signifies a positive effect for income inequality. This decrease shows that between the independent variable, indirect taxes and the dependent variable, Gini coefficient there is an inversely proportional relation.

Probability $0.36 > 0.05$ shows a statistically insignificant influence.

The coefficient of determination $R^2 0.005 < 0.6$ shows a weak link between the independent variable, indirect taxes (% in GDP) and the dependent variable, Gini coefficient (inequality). This means that only 0.5% of the dependent variable, Gini coefficient (inequality) is due to the contribution of the independent variable, indirect taxes. **(Tabel 4, see Annex)**

Conclusion *The model shows that the independent variable, indirect taxes exerts an insignificant influence on the dependent variable (Gini coefficient), its effect being positive, of diminishing the income inequality (Gini coefficient), between the two variables existing an inversely proportional relation. 0.5% of the dependent variable, Gini coefficient (inequality) is due to the contribution of the independent variable, indirect taxes.*

Independent variable: VAT (% in GDP) (TVAPIB)

The coefficient 0.26 shows that the independent variable VAT (% in GDP) has a positive influence on the dependent variable, the Gini coefficient (inequality). An increase of 1 unit of the independent variable VAT is associated with an increase of 0.26, of the dependent variable, Gini coefficient (inequality), which signifies a negative effect, for income inequality. This decrease shows that between the independent variable VAT and the dependent variable, Gini coefficient, there is a directly proportional relation.

Probability $0.26 > 0.05$ shows a statistically insignificant influence of the independent variable on the dependent variable.

The coefficient of determination R^2 $0.005 < 0.6$ shows a weak link between the independent variable VAT and the dependent variable, Gini coefficient (inequality). This means that only 0.5% of the dependent variable, Gini coefficient (inequality) is due to the contribution of the independent variable, VAT. **(Tabel 4, see Annex)**

Conclusion *The independent variable VAT exerts an insignificant influence on the dependent one (Gini coefficient), this having a negative effect, of increasing the income inequality, between the two variables, existing a directly proportional relation. Only 0.5% of the dependent variable, Gini coefficient (inequality) is due to the contribution of the independent variable VAT.*

Descriptive statistics. For the 4 models developed, 5 independent variables were used: total taxes, direct taxes, tax revenues, indirect taxes, VAT, expressed as % in GDP and the dependent variable, GINI coefficient (inequality). There is a number of 243 observations, for each variable. **(Tabel 5, see Annex)**

4.3. Models with dependent variable - poverty rate (Persons at risk of poverty or social exclusion)

MODEL 1

1) RISCAREXCLSOC= F(IMPTOTALPIB)

Independent variable, total taxes (% in GDP) (IMPTOTALPIB)

Coefficient -0.46 shows a negative influence of the independent variable, total taxes (% in GDP), on the dependent variable, the poverty rate (Persons at risk of poverty or social exclusion). A 1-unit increase in the independent variable, total taxes is associated with a decrease of 0.46 in the dependent variable, poverty rate (Persons at risk of poverty or social exclusion), which means a positive effect for the poverty rate. This decrease shows that between the independent variable, total taxes and the dependent variable, poverty rate (Persons at risk of poverty or social exclusion), there is an inversely proportional relationship.

Probability $0.0 < 0.05$ shows a statistically significant influence of the independent variable, total taxes on dependent variable poverty rate (Persons at risk of poverty or social exclusion) which means that changes in taxation are statistically reflected on the level of inequality.

The coefficient of determination R^2 $0.18 < 0.6$ shows a weak link between the independent variable, total taxes (% in GDP) and the dependent variable, the poverty rate (Persons at risk of poverty or social exclusion). This indicates that only 18% of the dependent variable, poverty rate is due to the contribution of the independent variable, total taxes. **(Tabel 6, see Annex)**

Conclusion *The model shows the significant influence of the independent variable, total taxes, on the dependent variable, poverty rate (Persons at risk of poverty or social exclusion), with a positive effect on the poverty rate, by reducing it, with the mention that only 18% of the dependent variable poverty rate is due to the contribution of the independent variable, total taxes.*

MODEL 2 2) RISCAREXCLSOC= F(IMPDIRPIB, IMPINDIRPIB)

Independent variable: direct taxes (% in GDP) (IMPDIRPIB)

Coefficient (- 0.44) shows that the independent variable, direct taxes (% in GDP) exerts a negative influence on the dependent variable, the poverty rate (Persons at risk of poverty or social exclusion). An increase of 1 unit of the independent variable VAT is associated with a decrease of 0.44 of the dependent variable, poverty rate, which signifies a positive effect. This decrease shows that between the independent variable, direct taxes and the dependent variable poverty rate there is an inversely proportional relationship.

Probability $0.0 < 0.05$ shows a statistically significant influence of the independent variable, direct taxes, on the dependent variable, poverty rate (Persons at risk of poverty or social exclusion). This shows the link between tax changes and the poverty rate (Persons at risk of poverty or social exclusion).

The coefficient of determination R^2 $0.12 < 0.6$ indicates a weak link between the independent variable, direct taxes (% in GDP) and the dependent variable, poverty rate (Persons at risk of poverty or social exclusion). This shows that only 12% of the dependent variable, poverty rate (Persons at risk of poverty or social exclusion) is due to the contribution of the independent variable, direct taxes. **(Tabel 7, see Annex)**

Conclusion *The model signalizes the significant influence of the independent variable, direct taxes on the dependent variable, poverty rate (Persons at risk of poverty or social exclusion), with a positive effect on the poverty rate, by reducing it, with the mention that only 12% of the dependent variable, poverty rate is due to the contribution of the independent variable, direct taxes.*

Independent variable: indirect taxes (% in GDP) (IMPINDIRPIB)

Coefficient 0.11 shows a positive influence of the independent variable, indirect taxes (% in GDP), on the dependent variable, the poverty rate (Persons at risk of poverty or social exclusion). A 1-unit increase in the independent variable, indirect taxes is associated with an increase of 0.11 in the dependent variable, poverty rate (Persons at risk of poverty or social exclusion), which signifies a negative effect for the poverty rate. This increase shows that between the independent variable, indirect taxes and the dependent variable, poverty rate there is a directly proportional relationship.

Probability $0.42 > 0.05$ shows a statistically insignificant influence of the independent variable, indirect taxes, on the dependent variable, poverty rate (Persons at risk of poverty or social exclusion).

The coefficient of determination R^2 $0.12 < 0.6$ shows a weak link between the independent variable, indirect taxes (% in GDP) and the dependent variable, the poverty rate (Persons at risk of poverty or social exclusion). This shows that only 12% of the dependent variable, poverty rate (Persons at risk of poverty or social exclusion) is due to the contribution of the independent variable, indirect taxes. **(Tabel 7, see Annex)**

Conclusion *The model shows the insignificant influence of the independent variable, indirect taxes, on the dependent variable, poverty rate (Persons at risk of poverty or social exclusion). The independent variable (indirect taxes) exerts a negative effect on the dependent one (poverty rate), mentioning that only 12% of the dependent variable, poverty rate (Persons at risk of poverty or social exclusion) is due to the contribution of the independent variable, indirect taxes.*

MODEL 3 3) RISCSAREXCLSOC= F(IMPDIRPIB, VENITURIPB)

Independent variable: direct taxes (% in GDP) (IMPDIRPIB)

Coefficient (-0.34) shows a negative influence of the independent variable direct taxes (% in GDP) on the dependent variable, poverty rate (Persons at risk of poverty or social exclusion). A 1-unit increase in the independent variable, direct taxes is associated with a decrease of 0.34 in the dependent variable, which signifies a positive effect for the poverty rate (Persons at risk of poverty or social exclusion). This decrease shows that between the independent variable, direct taxes and the dependent variable poverty rate, there is an inversely proportional relationship.

Probability $0.0 < 0.05$ shows a statistically significant influence of the independent variable, direct taxes and the dependent variable, poverty rate (Persons at risk of poverty or social exclusion.). This shows the link between tax changes and the poverty rate.

The coefficient of determination R^2 $0.18 < 0.6$ shows a weak link between the independent variable, direct taxes (% in GDP) and the dependent one, the poverty rate (Persons at risk of poverty or social exclusion). This indicates that only 18% of the dependent variable, poverty rate is due to the contribution of the independent variable, direct taxes. **(Tabel 8, see Annex)**

Conclusion *The model signals the significant influence of the independent variable, direct taxes, on the dependent variable, poverty rate (Persons at risk of poverty or social exclusion). The direct taxes have a positive effect on the poverty rate, of reducing it, with the mention that only 18% of the dependent variable, the poverty rate (Persons at risk of poverty or social exclusion) is due to the contribution of the independent variable, direct taxes.*

Independent variable: tax revenues (% in GDP) (VENITURIPB)

Coefficient (- 1.39) shows a negative influence of the independent variable tax revenues (% in GDP), on the dependent variable, the poverty rate (Persons at risk of poverty or social exclusion). A 1-unit increase in the independent variable, tax revenues is associated with a decrease of 1.39% in the dependent variable, which means a positive effect for the poverty rate (Persons at risk of poverty or social exclusion). This decrease shows that between the independent variable, tax revenues and the dependent variable, poverty rate, there is an inversely proportional relationship.

Probability $0.0 < 0.05$ shows a statistically significant influence of the independent variable, tax revenues on the dependent variable, poverty rate (Persons at risk of poverty or social exclusion). This shows the link between tax changes and the poverty rate (Persons at risk of poverty or social exclusion).

The coefficient of determination R^2 $0.18 < 0.6$ shows a weak link between the independent variable, tax revenues (% IN GDP) and the dependent variable, poverty rate (Persons at risk of poverty or social exclusion). It indicates that only 18% of the dependent variable, the poverty rate (Persons at risk of poverty or social exclusion) is due to the contribution of the independent variable, tax revenues. **(Tabel 8, see Annex)**

Conclusion *The model signalizes the significant influence of the independent variable, tax revenues, on the dependent variable, poverty rate (Persons at risk of poverty or social exclusion). Tax revenues have a positive effect on the poverty rate, of reducing it, with the mention that only 18% of the dependent variable, poverty rate is due to the contribution of independent variable, tax revenues.*

MODEL 4 4) RISCSAREXCLSOC= F(IMPINDIRPIB, TVAIPB)

Independent variable: indirect taxes (% in GDP) (IMPINDIRPIB)

Coefficient 0.11 shows a positive influence of the independent variable, indirect taxes (% in GDP) on the dependent variable, poverty rate (Persons at risk of poverty or social exclusion). An increase of 1 unit of the independent variable, indirect taxes is associated with an increase of 0.11 of the dependent variable, poverty rate (Persons at risk of poverty or social exclusion), which signifies a negative effect, for the poverty rate. This increase shows that between the independent variable, indirect taxes and the dependent variable, poverty rate, there is a directly proportional relationship.

Probability $0.62 > 0.05$ shows a statistically insignificant influence of the independent variable, indirect taxes on the dependent variable, poverty rate (Persons at risk of poverty or social exclusion).

The coefficient of determination R^2 $0.001 < 0.6$ shows a weak link between the independent variable, indirect taxes (% in GDP) and the dependent one, poverty rate (Persons at risk of poverty or social exclusion). It indicates that only 0.1% of the dependent variable, poverty rate (Persons at risk of poverty or social exclusion) is due to the contribution of the independent variable, indirect taxes. **(Tabel 9, see Annex)**

Conclusion *The model shows an insignificant influence, of the independent variable, indirect taxes, on the dependent variable, poverty rate (Persons at risk of poverty or social exclusion) and a negative effect of its increase, on the of poverty rate, noting that only 0.1% of the dependent variable poverty rate is due to the contribution of the independent variable, indirect taxes.*

Independent variable: VAT (% in GDP) (TVAIPB)

Coefficient (-0.23) shows a negative influence of the independent variable, VAT (% in GDP) on the dependent variable, poverty rate (Persons at risk of poverty or social exclusion). A 1-unit increase in the independent variable, VAT is associated with a decrease of 0.23 in the dependent variable, poverty rate (Persons at risk of poverty or social exclusion), which means a positive effect for the poverty rate. This decrease shows that between the independent variable VAT and the dependent variable, poverty rate, there is an inversely proportional relationship.

Probability $0.56 > 0.05$ shows a statistically insignificant influence of the independent variable VAT on the dependent variable poverty rate (Persons at risk of poverty or social exclusion).

The **coefficient of determination R^2** $0.001 < 0.6$ shows a weak link between the independent variable VAT (% in GDP) and the dependent variable, the poverty rate (Persons at risk of poverty or social exclusion). This indicates that only 0.1% of the dependent variable poverty rate is due to the contribution of the independent variable, VAT. **(Tabel 9, see Annex)**

Conclusion *The model signalizes the insignificant influence of the independent variable, VAT on the dependent variable, poverty rate (Persons at risk of poverty or social exclusion). VAT has exerted a positive effect on the poverty rate, of reducing it, with the mention that only 0.1% of the dependent variable, poverty rate is due to the contribution of the independent variable VAT.*

Descriptive statistics. For the four models developed, five independent variables were used: total taxes, direct taxes, tax revenues, indirect taxes, VAT, expressed as % in GDP and the dependent variable, poverty rate (Persons at risk of poverty or social exclusion). There is a number of 216 observations for each variable. (**Tabel 10, see Annex**)

5. Conclusions

From the study undertaken in the present paper it can be observed essential elements that drive on the results concerning the impact of different types of taxes on inequality (Gini coefficient). Thus, from theoretical background it can be observed that different authors developed significant researches on this topic area - the impact of taxation on inequality (Gini coefficient), using different models and reached relevant conclusions on this subject.

The idea that can stand out is that various elements intervenes and influence the impact of taxes on inequality (Gini coefficient), as for example: the level of economic development and specificity of country's tax system, conjuncture of country reforms, human behaviour in relation to tax evasion, financial inclusion, progressive taxes, risk resilience of entrepreneurs and their skills to invest in efficient projects, changes on people's economic status – assessed in income and others.

For finding on the relations between the variations of taxation and the indicators of inequality (Gini coefficient) and poverty rate (Persons at risk of poverty or social exclusion), regression models were used. For that purpose, data on taxes, as well as those from the structure of taxation, respectively, total taxes, direct taxes and indirect taxes, VAT, along with the indicators of inequality (Gini coefficient) and poverty rate (Persons at risk of poverty or social exclusion) were taken into account.

Eight simple regression models that show the variations in taxation and indicators of inequality were developed with the *dependent* variables: Gini coefficient (inequality) and poverty rate (Persons at risk of poverty or social exclusion) and *independent* variables: total taxes (% in GDP); direct taxes (% of GDP); tax revenue (% in GDP); indirect taxes (% in GDP); VAT (% of GDP). Each four models were developed for each two dependent variables. From each model it could be drawn conclusions on the basis of the influence of the independent variable on the dependent variable, taking into account the variations of values taken by the coefficients, probability, coefficient of determination R^2 which gives different influence and correlations between the independent variables and dependent variables.

5. Acknowledgment

This article is a part of the research paper achieved in the year 2024, by a research team of Institute of National Economy, Romanian Academy "Fiscalitate și inegalitate: provocări pentru creștere economică robustă și incluziune socială pentru toți" [Taxation and inequality: challenges for robust economic growth and social inclusion for all].

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ANNEX

Models with dependent variable - Gini coefficient (inequality)

TABLE 1

MODEL 1

Dependent Variable: COEFGINI

Method: Panel Least Squares

Sample: 2014 2022

Periods included: 9

Cross-sections included: 27

Total panel (balanced) observations: 243

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IMPTOTALPIB	-0.276019	0.039575	-6.974536	0.0000
C	39.84456	1.460853	27.27487	0.0000
R-squared	0.167945	Mean dependent var		29.78765
Adjusted R-squared	0.164492	S.D. dependent var		3.995195
S.E. of regression	3.651853	Akaike info criterion		5.436543
Sum squared resid	3213.983	Schwarz criterion		5.465292
Log likelihood	-658.5400	Hannan-Quinn criter.		5.448123
F-statistic	48.64416	Durbin-Watson stat		0.076033
Prob(F-statistic)	0.000000			

Source: processing data from European Commission, 2024, DG Taxation and Customs Union based on Eurostat data, Data on Taxation Trends, https://taxation-customs.ec.europa.eu/taxation/economic-analysis/data-taxation-trends_en; Eurostat Database, <https://ec.europa.eu/eurostat>; Eurostat: Gini coefficient of equivalised disposable income by age, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_di12/default/table?lang=en; Eurostat: Persons at risk of poverty or social exclusion by age and sex, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_peps01n/default/table?lang=en

TABLE 2

MODEL 2

Dependent Variable: COEFGINI

Method: Panel Least Squares

Sample: 2014 2022

Periods included: 9

Cross-sections included: 27

Total panel (balanced) observations: 243

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IMPDIRPIB	-0.227797	0.047348	-4.811142	0.0000
IMPINDIRPIB	0.042525	0.084542	0.503007	0.6154
C	31.79196	1.265987	25.11238	0.0000

R-squared	0.088022	Mean dependent var	29.78765
Adjusted R-squared	0.080423	S.D. dependent var	3.995195
S.E. of regression	3.831176	Akaike info criterion	5.536490
Sum squared resid	3522.699	Schwarz criterion	5.579614
Log likelihood	-669.6835	Hannan-Quinn criter.	5.553860
F-statistic	11.58217	Durbin-Watson stat	0.061809
Prob(F-statistic)	0.000016		

Source: processing data from European Commission, 2024, DG Taxation and Customs Union based on Eurostat data, Data on Taxation Trends, https://taxation-customs.ec.europa.eu/taxation/economic-analysis/data-taxation-trends_en; Eurostat Database, <https://ec.europa.eu/eurostat>; Eurostat: Gini coefficient of equivalised disposable income by age, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_di12/default/table?lang=en; Eurostat: Persons at risk of poverty or social exclusion by age and sex, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_peps01n/default/table?lang=en

TABLE 3
MODEL 3

Dependent Variable: COEFGINI

Method: Panel Least Squares

Sample: 2014 2022

Periods included: 9

Cross-sections included: 27

Total panel (balanced) observations: 243

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IMPDIRPIB	-0.180725	0.048292	-3.742327	0.0002
VENITURIPIB	-0.648205	0.213113	-3.041608	0.0026
C	33.68329	0.725403	46.43390	0.0000
R-squared	0.120946	Mean dependent var		29.78765
Adjusted R-squared	0.113621	S.D. dependent var		3.995195
S.E. of regression	3.761385	Akaike info criterion		5.499720
Sum squared resid	3395.524	Schwarz criterion		5.542845
Log likelihood	-665.2160	Hannan-Quinn criter.		5.517090
F-statistic	16.51041	Durbin-Watson stat		0.068664
Prob(F-statistic)	0.000000			

Source: processing data from European Commission, 2024, DG Taxation and Customs Union based on Eurostat data, Data on Taxation Trends, https://taxation-customs.ec.europa.eu/taxation/economic-analysis/data-taxation-trends_en; Eurostat Database, <https://ec.europa.eu/eurostat>; Eurostat: Gini coefficient of equivalised disposable income by age, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_di12/default/table?lang=en; Eurostat: Persons at risk of poverty or social exclusion by age and sex, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_peps01n/default/table?lang=en

TABLE 4

MODEL 4

Dependent Variable: COEFGINI

Method: Panel Least Squares

Sample: 2014 2022

Periods included: 9

Cross-sections included: 27

Total panel (balanced) observations: 243

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IMPINDIRPIB	-0.119974	0.131519	-0.912217	0.3626
TVAPIB	0.268638	0.241995	1.110099	0.2681
C	29.36667	1.362519	21.55322	0.0000
R-squared	0.005174	Mean dependent var		29.78765
Adjusted R-squared	-0.003117	S.D. dependent var		3.995195
S.E. of regression	4.001416	Akaike info criterion		5.623442
Sum squared resid	3842.719	Schwarz criterion		5.666567
Log likelihood	-680.2483	Hannan-Quinn criter.		5.640812
F-statistic	0.624064	Durbin-Watson stat		0.056683
Prob(F-statistic)	0.536630			

Source: processing data from European Commission, 2024, DG Taxation and Customs Union based on Eurostat data, Data on Taxation Trends, https://taxation-customs.ec.europa.eu/taxation/economic-analysis/data-taxation-trends_en; Eurostat Database, <https://ec.europa.eu/eurostat>; Eurostat: Gini coefficient of equivalised disposable income by age, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_di12/default/table?lang=en; Eurostat: Persons at risk of poverty or social exclusion by age and sex, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_peps01n/default/table?lang=en

TABLE 5

Descriptive statistics for models with dependent variable GINI Coefficient

	COEFGINI	IMPTOTALPIB	IMPDIRPIB	VENITURIPIB	IMPINDIRPIB	TVAPIB
Mean	29.78765	36.43550	11.42917	2.823339	14.09104	7.860157
Median	29.20000	36.69826	10.36562	2.633215	14.00928	7.655952
Maximum	40.80000	48.90441	32.79244	6.604745	22.50157	13.30266
Minimum	20.90000	19.77849	4.695796	0.156021	6.428112	3.398645
Std. Dev.	3.995195	5.931727	5.247098	1.189010	2.938630	1.597078
Skewness	0.344703	-0.299419	1.727368	1.156216	0.590600	0.663938
Kurtosis	2.718741	2.700847	7.087308	4.312194	3.775050	5.074987
Jarque-Bera	5.613164	4.537000	289.9930	71.57558	20.20886	61.44683
Probability	0.060411	0.103467	0.000000	0.000000	0.000041	0.000000
Sum	7238.400	8853.826	2777.288	686.0713	3424.124	1910.018

Sum Sq. Dev.	3862.703	8514.864	6662.754	342.1262	2089.802	617.2593
Observations	243	243	243	243	243	243

Source: processing data from European Commission, 2024, DG Taxation and Customs Union based on Eurostat data, Data on Taxation Trends, https://taxation-customs.ec.europa.eu/taxation/economic-analysis/data-taxation-trends_en; Eurostat Database, <https://ec.europa.eu/eurostat>; Eurostat: Gini coefficient of equivalised disposable income by age, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_di12/default/table?lang=en; Eurostat: Persons at risk of poverty or social exclusion by age and sex, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_peps01n/default/table?lang=en

Models with dependent variable - poverty rate (people at risk of poverty or social exclusion)

TABLE 6

MODEL 1

Dependent Variable: RISCSAREXCLSOC

Method: Panel Least Squares

Sample: 2015 2022

Periods included: 8

Cross-sections included: 27

Total panel (balanced) observations: 216

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IMPTOTALPIB	-0.467006	0.066824	-6.988608	0.0000
C	38.82129	2.468373	15.72748	0.0000
R-squared	0.185818	Mean dependent var		21.79398
Adjusted R-squared	0.182014	S.D. dependent var		6.431269
S.E. of regression	5.816606	Akaike info criterion		6.368527
Sum squared resid	7240.241	Schwarz criterion		6.399780
Log likelihood	-685.8009	Hannan-Quinn criter.		6.381153
F-statistic	48.84064	Durbin-Watson stat		0.050736
Prob(F-statistic)	0.000000			

Source: processing data from European Commission, 2024, DG Taxation and Customs Union based on Eurostat data, Data on Taxation Trends, https://taxation-customs.ec.europa.eu/taxation/economic-analysis/data-taxation-trends_en; Eurostat Database, <https://ec.europa.eu/eurostat>; Eurostat: Gini coefficient of equivalised disposable income by age, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_di12/default/table?lang=en; Eurostat: Persons at risk of poverty or social exclusion by age and sex, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_peps01n/default/table?lang=en

TABLE 7

MODEL 2

Dependent Variable: RISCSAREXCLSOC

Method: Panel Least Squares

Sample: 2015 2022

Periods included: 8

Cross-sections included: 27

Total panel (balanced) observations: 216

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IMPDIRPIB	-0.448987	0.079659	-5.636343	0.0000
IMPINDIRPIB	0.110700	0.138734	0.797925	0.4258
C	25.37588	2.091670	12.13188	0.0000

R-squared	0.129829	Mean dependent var	21.79398
Adjusted R-squared	0.121658	S.D. dependent var	6.431269
S.E. of regression	6.027379	Akaike info criterion	6.444293
Sum squared resid	7738.140	Schwarz criterion	6.491172
Log likelihood	-692.9836	Hannan-Quinn criter.	6.463232
F-statistic	15.88969	Durbin-Watson stat	0.046075
Prob(F-statistic)	0.000000		

Source: processing data from European Commission, 2024, DG Taxation and Customs Union based on Eurostat data, Data on Taxation Trends, https://taxation-customs.ec.europa.eu/taxation/economic-analysis/data-taxation-trends_en; Eurostat Database, <https://ec.europa.eu/eurostat>; Eurostat: Gini coefficient of equivalised disposable income by age, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_di12/default/table?lang=en; Eurostat: Persons at risk of poverty or social exclusion by age and sex, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_peps01n/default/table?lang=en

TABLE 8

MODEL 3

Dependent Variable: RISCSAREXCLSOC

Method: Panel Least Squares

Sample: 2015 2022

Periods included: 8

Cross-sections included: 27

Total panel (balanced) observations: 216

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IMPDIRPIB	-0.343192	0.080361	-4.270611	0.0000
VENITURIPIB	-1.391286	0.352648	-3.945250	0.0001
C	29.69439	1.201903	24.70614	0.0000
R-squared	0.186662	Mean dependent var		21.79398
Adjusted R-squared	0.179025	S.D. dependent var		6.431269
S.E. of regression	5.827222	Akaike info criterion		6.376749
Sum squared resid	7232.737	Schwarz criterion		6.423628
Log likelihood	-685.6889	Hannan-Quinn criter.		6.395688
F-statistic	24.44193	Durbin-Watson stat		0.062130
Prob(F-statistic)	0.000000			

Source: processing data from European Commission, 2024, DG Taxation and Customs Union based on Eurostat data, Data on Taxation Trends, https://taxation-customs.ec.europa.eu/taxation/economic-analysis/data-taxation-trends_en; Eurostat Database, <https://ec.europa.eu/eurostat>; Eurostat: Gini coefficient of equivalised disposable income by age, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_di12/default/table?lang=en; Eurostat: Persons at risk of poverty or social exclusion by age and sex, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_peps01n/default/table?lang=en

TABLE 9

MODEL 4

Dependent Variable: RISCSAREXCLSOC

Method: Panel Least Squares

Sample: 2015 2022

Periods included: 8

Cross-sections included: 27

Total panel (balanced) observations: 216

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IMPINDIRPIB	0.111413	0.224916	0.495353	0.6209
TVAPIB	-0.235752	0.412881	-0.570993	0.5686
C	22.08102	2.289131	9.646027	0.0000
R-squared	0.001573	Mean dependent var		21.79398
Adjusted R-squared	-0.007802	S.D. dependent var		6.431269
S.E. of regression	6.456307	Akaike info criterion		6.581784
Sum squared resid	8878.672	Schwarz criterion		6.628663
Log likelihood	-707.8326	Hannan-Quinn criter.		6.600723
F-statistic	0.167815	Durbin-Watson stat		0.038505
Prob(F-statistic)	0.845622			

Source: processing data from European Commission, 2024, DG Taxation and Customs Union based on Eurostat data, Data on Taxation Trends, https://taxation-customs.ec.europa.eu/taxation/economic-analysis/data-taxation-trends_en; Eurostat Database, <https://ec.europa.eu/eurostat>; Eurostat: Gini coefficient of equivalised disposable income by age, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_di12/default/table?lang=en; Eurostat: Persons at risk of poverty or social exclusion by age and sex, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_peps01n/default/table?lang=en

TABLE 10

Descriptive statistics for models with dependent variable poverty rate (People at risk of poverty or social exclusion)

	RISCSAREX CLSOC	IMPDIRPIB	IMPINDIRPI B	IMPTOTALP IB	TVAPIB	VENITURIPI B
Mean	21.79398	11.44829	14.07622	36.46056	7.869745	2.854517
Median	20.10000	10.19548	14.01428	36.73123	7.737172	2.680879
Maximum	46.00000	32.18018	22.50157	47.57925	13.30266	6.604745
Minimum	10.70000	4.695796	6.428112	19.77849	3.398645	0.156021
Std. Dev.	6.431269	5.199823	2.985659	5.936334	1.626431	1.184932
Skewness	1.225958	1.682852	0.557141	-0.381699	0.609732	1.077487
Kurtosis	4.753925	6.851558	3.723829	2.774043	4.981268	4.174809
Jarque-Bera	81.79329	235.4622	15.88998	5.704511	48.71266	54.21682
Probability	0.000000	0.000000	0.000354	0.057714	0.000000	0.000000
Sum	4707.500	2472.830	3040.464	7875.481	1699.865	616.5756
Sum Sq. Dev.	8892.662	5813.204	1916.545	7576.614	568.7350	301.8737
Observations	216	216	216	216	216	216

Source: processing data from European Commission, 2024, DG Taxation and Customs Union based on Eurostat data, Data on Taxation Trends, https://taxation-customs.ec.europa.eu/taxation/economic-analysis/data-taxation-trends_en; Eurostat Database, <https://ec.europa.eu/eurostat>; Eurostat: Gini coefficient of equivalised disposable income by age, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_di12/default/table?lang=en; Eurostat: Persons at risk of poverty or social exclusion by age and sex, Eurostat https://ec.europa.eu/eurostat/databrowser/view/ilc_peps01n/default/table?lang=en

Exploring the Future of IT Careers in Romania Amid Tax Incentive Cuts: A Case Study

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Abstract

This paper aims to offer insights into the future of IT careers in Romania by analyzing the responses to a questionnaire focused on employees' perceptions regarding the removal of the income tax exemption using IBM SPSS Statistics software. The sample consisted of 177 participants, and questions were structured into thematic categories: demographics, motivation and intentions to change profession, perceptions regarding the impact on the IT sector, migration of professionals and companies, salary and employer compensation, personal initiatives and government measures. Most IT workers intend to remain in their positions despite new fiscal measures. However, many are concerned about the industry's potential effects and are considering leaving the country or starting their own business. Participants who reported lower motivation were more likely to consider changing jobs or activity domain, and those having more years in the field were less likely to consider migration.

Key words: IT sector, tax incentive, employee perception, policy impact

J.E.L. classification: H24, O15

1. Introduction

A government ordinance declaring that "the information technology sector represents a priority activity that is expected to be stimulated, including through fiscal leverage" led to the introduction of tax incentives for the IT sector in Romania in the summer of 2001, making it one of the country's oldest fiscal facilities. Back then, it was evident that the IT industry was a growing and critical resource for the nation's economy, which stood to gain from lowering the personal income tax. Many politicians and economists have supported or opposed the idea over the years. (Popescu-Predulescu, 2024, p.585). In 2013, an amendment to the 2001 law greatly expanded the pool of eligible firms and workers by adding several newly eligible sector codes for the firms and bachelor's degree specializations for the workers (Manelici & Pantea, 2021, p.2)

Discussions regarding a possible elimination of tax incentives in the IT sector began in 2023. The first measures implied the introduction of a new threshold of 10,000 RON for the income tax exemption. However, as of January 1, 2025, this tax exemption has been completely eliminated. The legislative context that formed the basis of this decision is represented by Emergency Ordinance no. 156 of December 30, 2024, grounded on responding to a critical economic and budgetary situation, aiming to ensure the sustainability of public finances, to maintain the macroeconomic stability, and to respect international commitments, including those assumed by the National Plan of Redress and Resilience (PNRR), and in relation to the European Union, through the following measures:

- reducing the budget deficit;
- control of public spending;
- avoiding financing risks;
- ensuring the financing of public investments and European projects;
- compliance with PNRR milestones;
- need for rapid legislative intervention.

This paper aims to address a current gap in the literature, as this fiscal measure has been recently implemented and its effects are only beginning to unfold.

The scope of this paper is to analyze the impact of tax exemption removal from an employee perspective, offering insights into the future of IT careers in Romania. This study is organized as follows: it begins with a review of the relevant literature, followed by a description of the research methodology. The subsequent sections present the results and discussion of the questionnaire, concluding with the final remarks and references.

2. Literature review

To analyze the impact of tax policy on the economic and financial performance of companies in the IT sector, one should consider the overall situation in the country's IT sector. In addition to considering the indicators of the IT sector, it is also worth noting the costs in the country's economy for the technological and information component (Yakubovskiy *et al*, 2022, p.111).

Over the past two decades, Romania's IT sector has experienced remarkable growth, reflected in rising employment levels and a growing contribution to the gross domestic product, developments partly driven by the introduction of favorable fiscal policies. (Popescu-Predulescu, 2024, p.593). It created numerous, high-paying, knowledge-based jobs, enhanced the international exposure and reputation of our nation, contributed positively to the country's exports, and attracted substantial foreign direct investment (Văduva *et al*, 2014, p.458).

Another study by Manelici & Pantea (2021, p.1) supports the idea that this policy has been effective in supporting the development of the IT sector – a sector seen as key to the transition to a knowledge economy.

Research conducted by Fotache *et. al* (2020, p.9) revealed that professionals in the Romanian IT industry are well-positioned in their organizations, in line with their qualifications and knowledge, where they can continuously grow, diversifying their IT skills (over the next five years, most of them believe they will continue to work in this area).

Results of the HR Barometer survey made by PwC Romania at the beginning of 2025 revealed the following:

- only 10% of employers plan to adjust gross salaries in response to the removal of tax exemptions for employees in the IT, construction, and agriculture sectors;
- 40% of companies believe that staff turnover will increase among employees affected by legislative changes;
- 20% of companies plan to mitigate the impact of tax changes through additional benefits or training and professional development programs;
- a third of employers are considering migrating to other forms of collaboration;
- two-thirds of companies believe that eliminating the tax exemption will reduce the motivation and productivity of their employees.

3. Research methodology

The study takes a qualitative approach based on data collected through a 20-question online questionnaire designed to assess employees' perceptions regarding the effects of eliminating tax incentives. The target population comprises employees active in Romania's IT sector. Participants were selected through conventional sampling and distributed online through social networks and professional platforms.

Except for the demographic questions section, the questionnaire was composed exclusively of closed questions, with dichotomous response options (Yes/No), facilitating the quantitative data analysis. Answers were collected using a Google Forms form, and participation was anonymous and voluntary. Respondents were informed about the research's purpose and the data's use.

Table 1 presents the demographic characteristics of the survey respondents to better understand the context of the findings.

Table no. 1 Sample description

Characteristic	Categories	%
Gender	Male / Female	80.8 / 19.2
Age	<25 / 25–34 / 35–44 / 45–54 / 55+	35.0 / 44.1 / 11.9 / 6.2 / 2.8
Region	Muntenia / Transylvania / Moldova / Others	56.0 / 18.1 / 17.0 / 8.5
Experience (IT)	<1 yr / 1–3 yrs / 3–5 yrs / 5–10 yrs / >10 yrs	22.1 / 27.2 / 21.0 / 12.9 / 17.0

Source: Author's contribution

The sample consisted of 177 participants currently employed in the IT sector in Romania. The majority were male (80.8%), and most respondents were aged between 25 and 34 (44.1%), followed by those under 25 (35.0%). Respondents were geographically distributed across Romania, with the highest concentration in the Muntenia region (55.9%). In terms of experience, 27.2% had 1 to 3 years of experience, while 22.3% had less than one year in the field.

Data was processed using IBM SPSS Statistics software.

4. Findings

The questionnaire results are grouped into thematic categories to better understand how IT professionals perceive the recent fiscal changes.

Table no. 2 Questionnaire results

Thematic category	Questions	Yes	No
Motivation and intentions to change profession	Do you feel less motivated to work in IT because of the new tax regulations?	36.36%	63.64%
	Will you seek to change your field of activity due to the elimination of the tax exemption?	27.27%	72.73%
	Are you planning to change your job due to tax changes?	37.66%	62.34%
	Do you think that the elimination of the tax exemption will discourage new talents from choosing IT as a field of activity?	63.64%	36.36%
Perceptions regarding the impact on the IT sector	Do you think the elimination of tax exemptions will negatively affect the performance of the IT industry in Romania?	76.62%	23.38%
	Do you think that these tax changes will lead to a decrease in the attractiveness of IT jobs?	72.73%	27.27%
	Do you think the decision to cancel tax incentives will affect the quality of work in the IT field?	74.03%	25.97%
Migration of professionals and companies	Do you think that the new tax regulations will cause a migration of IT professionals to other countries?	80.52%	19.48%
	Would you consider moving to a country with more favorable tax facilities for IT?	58.44%	41.56%
	Do you think the elimination of the tax exemption will lead to a migration of IT companies from Romania?	67.53%	32.47%
Salary and employer compensation	Have you noticed a drop in IT salaries after the tax exemption was removed?	80.52%	19.48%
	Did your employer compensate for the loss of income due to the tax changes?	22.08%	77.92%
Personal initiatives and government measures	Have you considered starting your own IT business to compensate for the loss of the tax break?	49.35%	50.65%
	Do you think the government should reintroduce the income tax exemption for the IT sector?	77.92%	22.08%

	Would you like the government to implement other tax incentives to compensate for the loss of the IT income exemption?	84.42%	15.58%
	Do you trust that the government will implement sufficient measures to support the IT sector in the future?	20.78%	79.22%

Source: Author's contribution

Results show that most IT professionals do not intend to change jobs or field of activity even with the removal of the tax benefit. About three-thirds of respondents believe the new fiscal measures will negatively impact the sector in terms of performance, attractiveness, and quality of work. The majority of employees believe this will also cause a migration of personnel and companies to different countries. At the same time, over half of them would consider moving to a country with more favorable tax facilities. Most IT professionals noticed a drop in their salary after the tax exemption was removed, and approximately the same percentage of respondents stated they did not receive any compensation from their employer. Half of those considered starting their own business to compensate for this income loss. An overwhelming majority believes that income tax exemption or other tax incentives to compensate should be introduced. However, they are not confident that the government will implement sufficient measures to support the IT sector in the future.

Table no. 3 Crosstab analysis

Grouping variable	Opinion variable	p-value
Motivation to stay in IT	Intention to change domain	0.00
	Intention to change job	0.00
Age	Trust in future government support	0.04
Region	Performance of IT industry	0.06

Source: Author's contribution

A significant relationship was found between motivation and the intention to leave the IT domain. This raises concerns about labor force exodus, not only through migration but also through career reorientation. Participants who reported lower motivation were also more likely to consider changing jobs, suggesting that removing tax exemptions directly impacts workforce stability in the IT sector.

Regarding future government support, younger respondents tend to express lower trust than older ones, potentially influencing the emerging generation's willingness to stay in Romania.

Perceptions of how the tax changes will impact the IT industry's performance varied across regions, with a trend toward statistical significance. Regional differences may be linked to differences in job markets or economic conditions across the country.

Table no. 4 Binary logistic regression

Explanatory variables	p-value
Experience (IT)	0.048
Region	0.131
Intention to change domain	0.798
Intention to change job	0.066
Constant	0.533

Source: Author's contribution

In order to examine whether experience in the IT field, region, and dissatisfaction indicators, such as intention to change jobs or domain, can predict the intention to migrate, a binary logistic regression was conducted.

As a result, IT experience was identified as a statistically significant predictor, with those having more years in the field being less likely to consider migration. An explanation for this might be that individuals with greater experience might already have stable roles or better local opportunities.

Intention to change domain is a near-significant predictor, suggesting job dissatisfaction may be linked with the idea of leaving the country. In contrast, intention to change domain was not statistically significant for this hypothesis.

5. Conclusions

The issue of removing tax incentives for the IT sector is important, given its level of development and significance for the Romanian economy. The government must ensure that the measures taken, even if necessary to cover the budgetary deficit, do not destabilize a strategic resource for the country.

The study shows that while most IT professionals do not plan to change jobs or fields, they view the removal of tax benefits as a threat to the sector's performance and attractiveness. Many respondents expressed concerns about migration, income loss, and lack of government support, highlighting a need for new tax incentives.

This study's findings can be useful for investors, government policymakers, IT employers, and individuals considering a career in the field.

Research limitations include the sample size, sampling method, and cross-sectional design, which limit the ability to observe changes or trends over time.

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- * * * Emergency Ordinance no. 156 of 30 December 2024. Official Gazette, no. 1334, 31 December 2024

The Importance of Key Indicators in a Trading Company

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Abstract

In the activity of a commercial company, there are sometimes moments when financing problems arise because the cash flow does not have the expected values, and then analyses must be made to show the causes that led to financing through debt in relation to equity. These leverage indicators show how high the financial risk may be and how the commercial company may be able to meet its financial obligations. Here, it is very important to identify the factors that led to the company's high indebtedness, especially since shareholders may accuse the executive of excessive management of the company's liquidity and assets. A decrease in profit due to increased expenses is not welcomed by shareholders or even by executives, as their benefits may also be reduced to nothing. That is why the values of certain leverage indicators must be calculated periodically to prevent a lack of liquidity that could lead to the liquidation of the company, especially since there are situations when the company cannot resort to external loans, which could restore the company's smooth operation. The objective of this approach highlights the importance of leverage indicators, whose values can form the basis for decisions regarding the financing of a commercial company's activities.

Key words: leverage indicators, debt ratio, financial leverage, interest coverage

J.E.L. classification: D24, G32, M41

1. Introduction

Leverage indicators allow us to observe the use of debt within a commercial company. Debt is a term with a special meaning for a large part of the population, similar to a credit card that requires interest payments or a commercial company mired in debt to the bank. At the same time, we must take into account that debt can allow a commercial company to develop more than its own capital allows, which can lead to profits that ultimately lead to an increase in the volume of equity capital. In addition, the company can deduct the interest on the debt owed to the lending institution. The term used by finance specialists for debt is leverage. This term simply draws an analogy between an individual who uses a lever to move a weight heavier than normal and a commercial company, in order to develop its business, uses a modest amount of capital to develop its business and form higher-value assets through debts to banks.

At the same time, leverage indicators are important, as can be seen from the following:

a) *financial risk assessment* – a high level of leverage indicators signals that the company has more debt, which can lead to financial difficulties in more unfavorable economic periods; conversely, a low level of indicators indicates a more financially stable company but may also mean an untapped opportunity for growth;

b) *measuring capital structure* – shows the ratio between equity and total debt, helping to understand how the company finances its assets;

c) *assists in investment and lending decisions* – investors analyze these indicators to understand how risky it is to invest in the company, and banks and other lenders use leverage indicators to decide whether to grant a loan and under what conditions;

d) *reflects the ability to repay debts* – the indicators reveal whether the company has sufficient resources to meet its financial obligations;

e) *allows comparison between companies* – these indicators are used to compare different companies in the same sector, especially to identify the most financially balanced companies.

2. Theoretical background

The performance of commercial firms is influenced by a multitude of internal and external factors, which has led to numerous studies aimed at identifying key indicators that reflect their economic health. These indicators include corporate governance, firm size, financing policies, asset structure, financial performance, and ESG values.

The importance of corporate governance in improving company performance is highlighted in the literature, as it plays a significant role in streamlining decision-making and reducing risks (Soesetio, Rudiningtyas, and Sukmawati, 2023). Similarly, the analysis by Ahmad, Mobarek, and Raid (2023) highlights that, in the context of financial crises, corporate governance, together with ESG performance and firm size, plays a moderately important role in maintaining competitiveness.

From the perspective of financial indicators, especially in sensitive sectors such as agriculture and construction, it has been found that subsidy revenues can significantly influence turnover (Aivaz, 2021a), while non-compliance in asset reporting raises questions about the accuracy of financial reporting (Matei and Aivaz, 2023).

More recent analyses place firm performance in the broader context of institutional and economic influences, such as public policies and poverty levels (Jula et al., 2025). Complementarily, factors such as financial leverage, profitability, and dividend policy are associated with firm value, especially in competitive and volatile environments.

Financial leverage has been extensively studied in relation to firm performance and has been found to be a determining factor with varying impact across sectors and markets. Arhinful and Radmehr (2023) demonstrate this effect in the case of non-financial firms in Japan, while Odhiambo, Murori, and Aringo (2025) provide a comprehensive overview of the relationship between debt and performance in various organizational contexts.

Regarding companies in coastal areas of Romania, research has shown that the structure of fixed assets (Stan and Vintilă, 2021a), the degree of indebtedness (Stan and Vintilă, 2021) and stakeholders' perceptions of the impact of tourism (Stan and Aivaz, 2021b) can contribute to understanding local development and the performance of firms in these regions.

In addition, economic risks, fraud, and reorganization decision analysis are other important topics in assessing the competitiveness of commercial firms. Recent studies have highlighted the need for integrated risk analysis and decision-making models to support sustainability and organizational adaptability (Aivaz, Florea, and Munteanu, 2024; Stroie et al., 2023).

In conclusion, the literature supports the idea that the performance of commercial firms is the result of a complex set of financial, governance, and strategic factors, and understanding the interaction between these indicators is essential for strengthening market position and adopting effective financial management policies (Chiriac et al., Aivaz, 2021b).

3. Research methodology

The completion of any scientific research work implicitly involves the combined application of a number of research techniques and procedures, through which the researcher attempts to obtain the maximum number of conclusions, starting from previous research and supplementing it with their own experiences and results, in order to formulate a final conclusion on the topic analyzed. Thus, the very etymology of the Greek words *metodos* (way, path) and *logos* (science) points us in the same direction. Often, however, even if these methods and techniques are well defined at the

beginning of the research process, while the research it may become necessary to change them under the influence of external factors that may require the adoption of new methods of study or the abandonment of those already adopted.

From the outset, this paper was intended to be a qualitative study. During the research, it became increasingly clear that there was a need to expand the research with quantitative elements, designed to give greater relevance to the research conclusions and, at the same time, to eliminate subjective factors.

4. Findings

The most important leverage indicators are as follows:

a) *Degree of indebtedness (Debt-to-Equity Ratio – D/E):*

$$D/E = \frac{\text{Total debts}}{\text{Equity capital}} \quad (1)$$

This indicator shows how much debt there is for each dollar invested by shareholders. A high value for this indicator indicates a high degree of financial risk.

b) *Total debt ratio (Debt Ratio):*

$$\text{Debt ratio} = \frac{\text{Total debts}}{\text{Total assets}} \quad (2)$$

This indicator measures the share of assets financed by debt. If the value of this indicator is higher, this shows that the company is more dependent on external financing.

c) *Long-term debt ratio (Long-term Debt to Capitalization):*

$$\text{Long-term Debt to Capitalization} = \frac{\text{Long term debts}}{\text{Long term debts} + \text{Equity capital}} \quad (3)$$

This indicator shows long-term financial stability.

d) *Financial Leverage (Financial Leverage):*

$$\text{Financial Leverage} = \frac{\text{Total assets}}{\text{Equity capital}} \quad (4)$$

This indicator shows how much borrowed capital is used to support the company's assets.

e) *Interest coverage (Times Interest Earned – TIE):*

$$TIE = \frac{\text{Operational profit (EBIT)}}{\text{Interest expenses}} \quad (5)$$

This indicator shows the company's ability to pay interest from operating profit. A value below 1 for this indicator signals major problems with the solvency of the company.

A general interpretation of the values of these indicators is presented in Table 1.

Table no. 1 General interpretation of leverage indicators

Indicator	Meaning	"Healthy" values (depending on the industry)
D/E	Credit risk/External financing	<1,5 (ideally below 1 for stability)
Debt Ratio	Debt-to-asset ratio	0,3-0,6
Financial Leverage	Equity multiplication	1,5-3
TIE	Interest payment capacity	>3

Source: Author's processing

To illustrate the calculation of these leverage indicators, we used data from a commercial company in the construction industry, ASA CONS ROMÂNIA SRL. The data used was collected from the website www.termene.ro/Listafirme and includes data from the financial statements for the period 2015-2023:

Table no. 2 Financial information for ASA CONS ROMÂNIA SRL

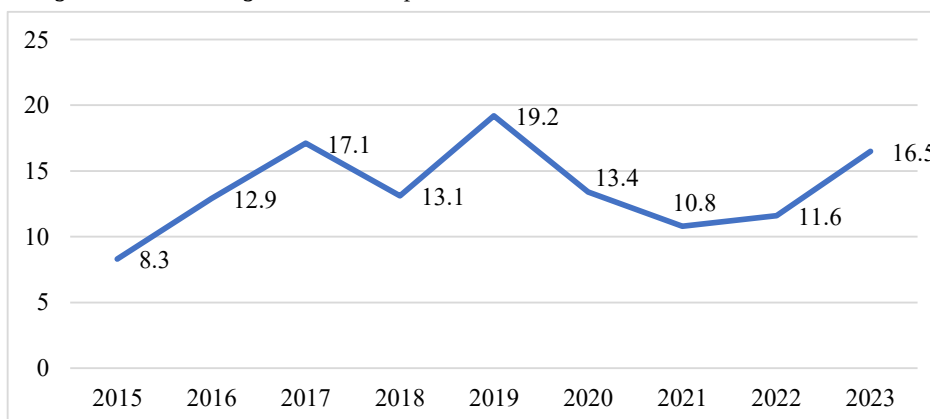
Year	Turnover (mil. RON)	Net profit (mil. RON)	Debts (mil. RON)	Total assets (mil. RON)	Equity (mil. RON)
2015	57,78	4,77	27,66	17,56	16,39
2016	78,21	10,07	23,52	49,99	26,47
2017	89,80	15,31	23,93	65,71	41,78
2018	116,88	15,29	17,12	65,16	47,75
2019	124,01	23,81	16,71	79,11	62,11
2020	87,16	11,66	13,45	80,27	66,54
2021	114,75	12,44	23,11	90,79	67,40
2022	158,08	18,36	32,03	110,65	78,34
2023	179,82	29,58	19,41	117,42	97,25

Source: Author's processing after www.termene.ro/Listafirme

Below are some leverage indicators, as the balance sheet information does not include interest or EBIT values to calculate the TIE indicator:

Net margin - calculated as the ratio between net profit and turnover. There was a significant increase in the margin between 2015 and 2019, with a decline in 2020 and a return to an upward trend, reaching a value of 16.5% in 2023, close to the 2017 value.

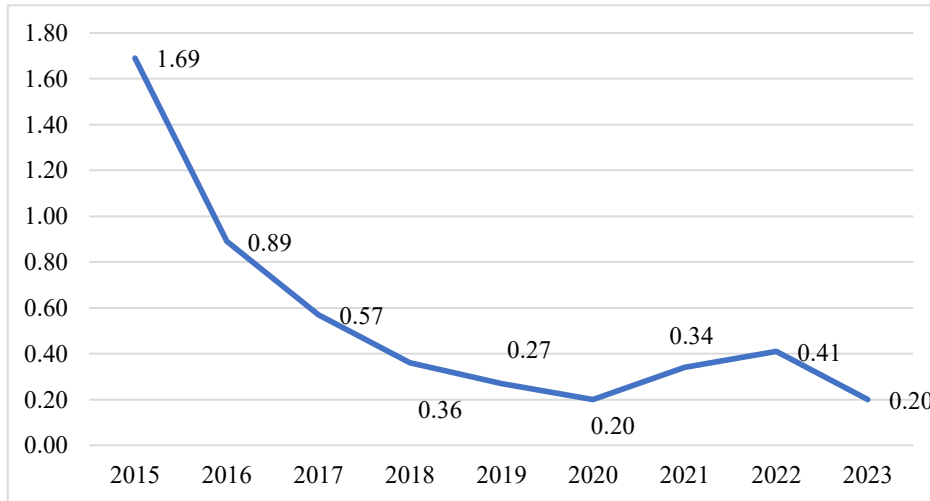
Figure no. 1 Net margin value in the period 2015-2023



Source: Author's processing

Debt ratio – calculated as the ratio between debt and equity. While the debt ratio was relatively high in 2015, it declined steadily between 2016 and 2019 and stabilized moderately between 2020 and 2023, although we should note a slight increase in 2022.

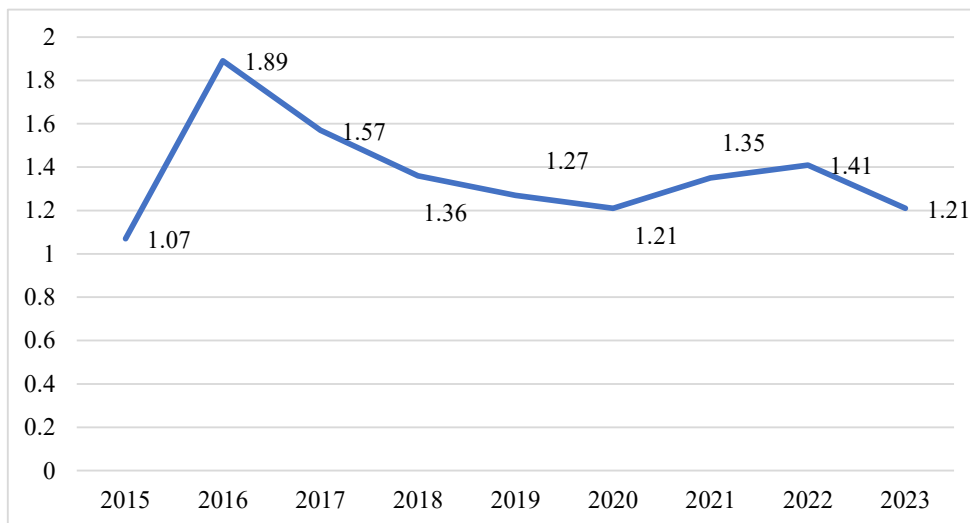
Figure no. 2 Debt ratio in the period 2015-2023



Source: Author's processing

Financial leverage – calculated as the ratio between total assets and equity. Financial leverage, which normally ranges between 1.5 and 3, is moderate and relatively stable after 2016 and indicates a balanced structure without excessive financial exposure.

Figure no. 3 Financial leverage in the period 2015-2023



Source: Author's processing

5. Conclusions

The analysis of leverage indicators highlights the importance of maintaining a balance between own and borrowed sources of financing. A high degree of indebtedness reduces the company's ability to cover financial costs, increasing the risk of insolvency. On the other hand, a moderate

level of debt, combined with solid profitability, supports healthy leverage indicators, providing flexibility and long-term financial stability. It is recommended to constantly monitor these indicators and adjust the financial strategy according to market developments. At the same time, we must take into account the fact that there are companies that are highly dependent on the credit system because it provides them with the cash flow necessary to carry out their activities, provided that they can cover the interest on the respective loans.

In the case study presented, we observed a decline in indicators after 2019, with the onset of the SARS-CoV-2 pandemic, and the effects of this pandemic were felt even in the first post-pandemic year, 2021. Even though efforts were made to recover the economy after this pandemic, unfortunately, the values of 2019, the year before the pandemic, were not reached, especially since a new global economic crisis is looming.

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ISSN-L 2393-3119
ISSN 2393-3127