The New Challenges of Artificial Intelligence in Digital Transformation and Economic Competitiveness

Nicoleta Sîrghi
West University of Timisoara, Romania
nicoleta.sirghi@e-uvt.ro
Maria Magdalena Doroiman
West University of Timisoara, Doctoral School of Economics and Business Administration,
maria.doroiman10@e-uvt.ro

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 all.,2020). Implementing AI into the social sphere brings privacy concerns, algorithmic discrimination, and effects on employment (Liu et all., 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 all, 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/

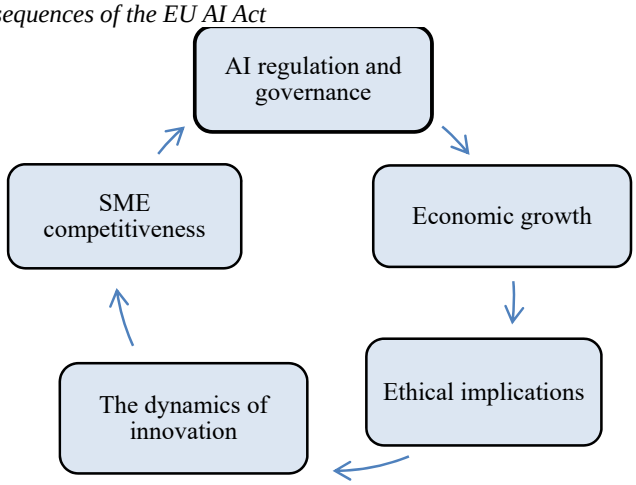
From Table 1 these regulations address a wide range of issues, from electronic identification and personal data protection to cybersecurity and the responsible use of artificial intelligence. The Artificial Intelligence Regulation (AI Act) establishes an ethical framework for the responsible development 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

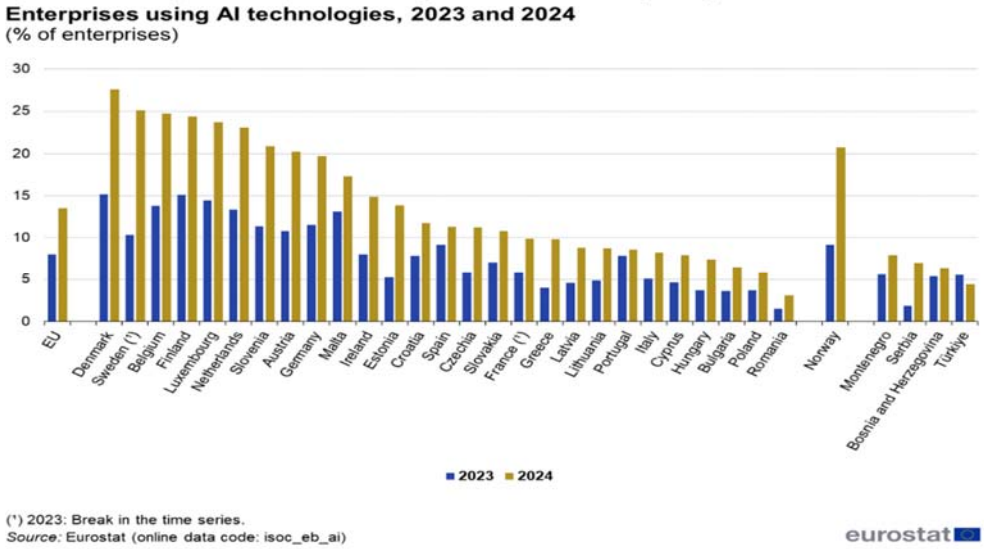
Figure 1 shows how these issues are interconnected and highlights the multifaceted approach that needs to be taken when examining the consequences of the EU AI Act from a business model perspective. AI has the potential to enhance operational productivity by automating tasks and decreasing expenditure. 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)

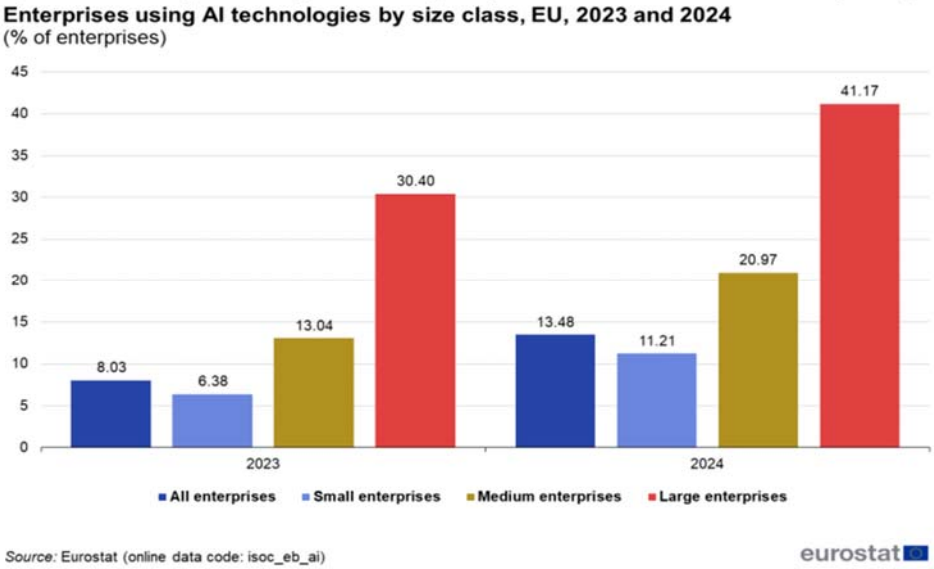


Source: Eurostat

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

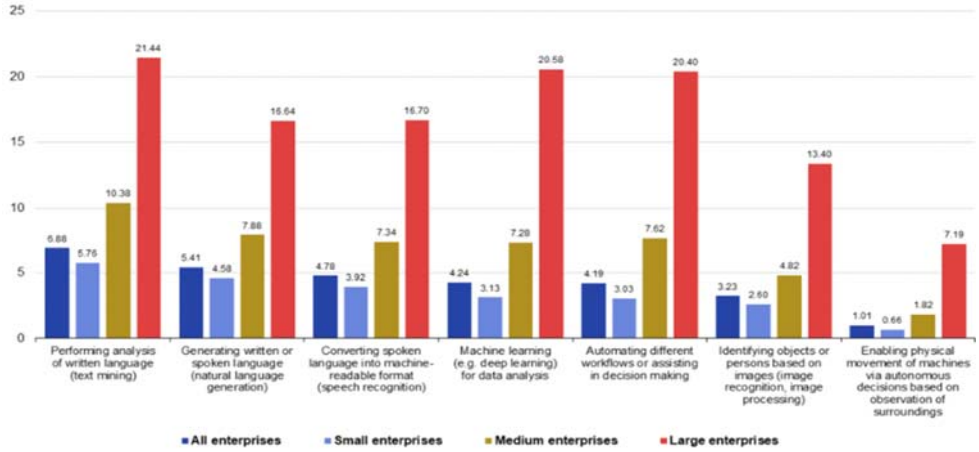


Source: Eurostat

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.

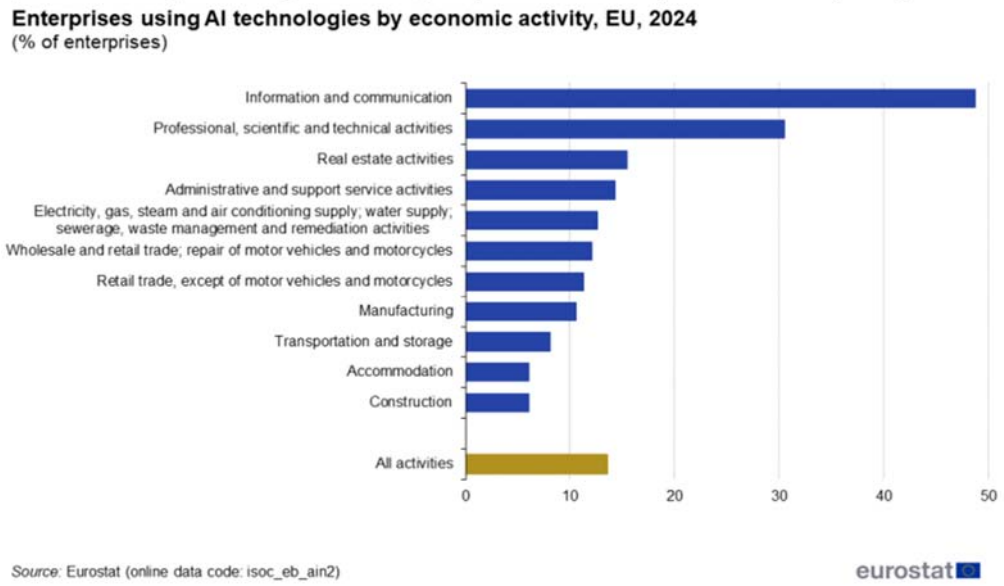
Figure no. 4 Enterprises using AI technologies by type of AI technology and size class, EU, 2024 (% of enterprises)



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)/



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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