A Comparative Analysis of Artificial Intelligence Adoption Rates: Romania vs. The European Union (2024-2026)

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Abstract

This paper explores the pattern trends and drivers of the adoption of artificial intelligence (AI) technologies by enterprises focusing on Romania and the European Union (EU) member states. Using Eurostat, OECD metrics, and relevant literature, Romania is always among the lowest adopters of AI technologies by enterprises in the EU. In 2025, it is projected that 5.21% of Romanian enterprises will adopt AI, compared to the EU average of 19.95% and to the leaders, Denmark with 42.03% and Finland with 37.82%. The paper uses a comparative approach, anchored in the Technology Acceptance Model (TAM) and the Technology-Organization-Environment (TOE) framework, to determine the structural, organizational, and environmental factors that decelerate Romania's adoption of AI. These include, among others, the lack of relevant digital skills, an immature ICT layer, an under-investment from the state, and low organizational preparedness. In addition, the paper analyses the implications of the EU AI Act (Regulation EU 2024-1689) on enterprises and how it will affect compliance and adoption. The research indicates that to close the AI adoption gap in Romania, a combination of policy changes, investment in digital skills, and organizational development to the extent that it complies with EU digital decade goals is needed.

Keywords: *Artificial intelligence adoption, digital transformation, comparative management, Technology Acceptance Model, TOE framework*

JEL classification: O33, L86, M15.

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1. Introduction

AI has sparked a technological revolution over the past 100 years that has transformed the industries, the future of work, and the global organization structures. Brynjolfsson and McAfee (2017) illustrate how the European Commission has understood the significance of AI in the competitiveness of the EU member states, and, therefore, proposed to embed it in the digital and economic competitiveness of the European Union. The European Union has recognized the importance of AI to its developed member states, and the European Commission has unveiled plans to incorporate it into the digital and economic competitiveness of the continent (European Commission, 2021). 78% of the world's companies reported use of AI in

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2024, according to the Stanford AI Index Report. This is a 23% increase from the previous year's 55%. It also reported that Generative AI investments increased by 18.7% from 2023 to 2024, totaling $33.9 billion (Perrault, et al, 2025). This McKinsey Global Survey also reported that >75% of its respondents stated that their companies use AI in their businesses. It also stated that larger organizations (>$500 million in annual revenue) are adopting AI more rapidly. (McKinsey, 2025).

There is still considerable inequality among EU member states in spite of this global momentum. Romania is a particularly glaring example. Romania is one of the countries in the EU with the lowest rate of adoption of AI technologies by businesses. This is a result of Romania's unique obstacles of digital disparities involving the rest of the European economic area (Business Forum Romania, 2025; World Economic Forum, 2025). Only 5.21% of Romanian businesses with 10 or more employees, which is the latest data from Eurostat, are using some form of AI technology, while the average in the EU is 19.95%, and in Denmark it is 42.03% (Eurostat, 2025). This gap is not simply a matter of a disadvantaged economic position, it is likely to severely impact Romania's economic competitiveness, productivity, and ability to engage in the digital single market. By 2040, McKinsey estimates that the economic impact of generative AI for Romania's GDP and public sector productivity is a cumulative EUR 30 billion to EUR 50 billion and up to EUR 1 billion per year, respectively (McKinsey, 2025).

This paper aims to fill this gap by developing a systematic comparative analysis of the patterns of AI adoption in Romania and the EU, explaining the main drivers of the differences, and offering insights to organizational strategy and public policy.

2. Theoretical Background and Literature Review

Researching technology adoption in organizations is a timeless topic in management research. It provides multiple theories in studying the various relationships and factors that either facilitate or constrain the implementation of new technologies. This section collates the available theoretical approaches concerning AI adoption and empirically reviews the existing literature, especially the European and Romanian contexts.

There are many theories in technology adoption literature. However, the most important, concerning the dynamics of AI integration, are the Technology Acceptance Model (TAM), the Technology-Organization-Environment (TOE) Framework, and Organizational Readiness.

The Technology Acceptance Model (TAM) is an extensively used model of user technology acceptance. According to the TAM, possible adopters of a new system are influenced by two factors: the users perceived usefulness (the degree to which a user believes that a system will help him/her perform his/her job better) and perceived ease of use (the degree to which a user believes that the system will involve little effort). The first version of TAM set out to analyze technology acceptance on a personal level. However, a number of recent studies applying the TAM framework have aimed at technology acceptance on the organizational level.

The primary focus of the recent work on AI technology acceptance is to see the relevance of TAM for an organizational context. Song, Qiu & Liu (2025) have used The Technology Acceptance Model (TAM) to determine the relevance of perceived usefulness for organizational investment and deployment of AI technologies considering management support and competitive pressure as peripheral influencing factors (Năstase et al., 2024). On the other hand, the most important criticism of TAM models is their focus on individual and organizational dimensions, which can miss critical structural and contextual factors that determine technology adoption pathways. In response to such a shortcoming, the Technology-Organization-Environment (TOE) framework by Tornatzky and Fleischer (1990) provides a better alternative with a broader perspective. The TOE framework suggests a combination of influences across three different contexts: the technological context (the availability and characteristics of the technologies themselves), the organizational context (firm size, structure, resources, and managerial support), and the environmental context (industry structure, competitive pressures, and the regulations) (Năstase, 2010). The TOE framework fits well with the analysis of AI adoption because it captures the detailed interactions of the different internal and external factors. For instance, a recent study that applied the TOE framework to AI adoption in SMEs cited a myriad of challenges, such as technological barriers (data access and quality), organizational barriers (lack of skills, cultural resistance), and environmental barriers (weak governance, lack of government support) (Sánchez, Calderón & Herrera, 2025). The multi-dimensional approach of this framework captures the complexity of the challenges that especially SMEs face in AI adoption, even with overwhelming evidence of the potential benefits (Antohi et al., 2022).

There has been recent focus on the Organizational Readiness concept along the organizational dimension of the TOE framework in the AI adoption literature. Uren and Edwards (2023) suggest that existing models of Technology Readiness cannot be applied to AI because it demands a more radical shift in the organizational processes and capabilities. They develop a framework of organizational readiness for AI along four dimensions: (1) People (skills, culture, and leadership); (2) Processes (workflows, governance, and data management); (3) Technology (infrastructure, tools, and platforms); and (4) Data (availability, quality, and accessibility). Such a framework is appropriate for Romania because, as this paper will illustrate, there are marked deficiencies along all four dimensions of organizational readiness despite a highly developed technological talent pool (Cristache et al., 2019).

2.1. Empirical Literature on AI Adoption in Europe and Romania

Adopting AI across Europe is highly varied due to the findings from Hoffmann and Nurski (2021), identified three barriers to AI adoption across Europe: lack of relevant skilled workforce, insufficient data, and low levels of funding. These barriers have been supported in several studies that have been published. In her

study, Stan et al. (2025) placed Romania in the most lagging cluster, which also shows the increasing digital divide of the EU whereby the Western and Northern European countries are advancing while the South and Eastern countries are lagging behind.

Scholarship focusing on Romania's status as an AI laggard is on the rise. Apostoaie's et al. (2025) empirical analysis on the Romanian SMEs' AI adoption revealed firm size, access to finance, and digital managerial literacy as the top three positive predictors of AI adoption. A specific study about Romanian supply chain management AI adoption difficulties conducted by Rugiubei and Stoica (2025) pointed out the lack of a strategic vision and the tendency of organizations to short-sightedly think about and manage costs as the most important barriers. Voda and Badea's (2025) study indicated that for the Romanian labor market, the key factors of AI adoption are the income levels and job experience of employees. As a result, there is uneven distribution of advantages derived from AI within the labor force. Focusing on relative comparison, Obreja (2025) noted Romania's and Euro Area's digital structural disparities, ranging from digital infrastructure to digital human resources. The KPMG report on AI adoption in CEE (2025) shows that the CEE region is witnessing extensive growth in the use of AI, but the region's understaffed and poorly managed digital governance slows the growth (Gabor et al., 2021).

According to the OECD (2025), there is a widening gap between the frontrunners and the stragglers in terms of the adoption of AI technologies. The OECD examines the AI adoption gap using its AI Policy Observatory.

The regulatory environment is a critical part of the adoption landscape. The EU AI Act (Regulation EU 2024/1689) is the first AI law to be enacted in the world and is considered to be the most comprehensive. It describes the various risks posed by AI and the compliance obligations of companies (European Commission, 2024). Cors, and Thiebaut (2025) discuss the repercussions of the EU AI Act on business organizations. According to the findings of their research, the regulation is likely to incur costs of compliance, especially on the part of small and medium enterprises (SMEs) and start-up firms. However, the regulation also has the potential of creating a trusted AI environment, thereby enhancing growth and consumer confidence in the market. This form of regulation, as shown by Bradford (2020), is what is referred to as the Brussels Effect—the European Union's (EU) ability to dominate and shape the world's regulatory environment through one-sided regulatory moves, leading to pan-EU compliance by businesses and a single market, as the economic burden of operating multiple distinct versions of a product is greater than the cost of conforming to the EU's regulatory framework.

The unauthorized use of AI tools by employees, which, as far as the organization knows, has yet to be approved, represents the emergence of another phenomenon that makes measuring the adoption of AI more difficult. The use of unauthorized AI tools at work was reported by about 66% of employees, including 30% of respondents who admitted to sharing private company data with openAI, and 2 out of 3 respondents stated that they do not trust AI to make decisions that affect them (Sweep, 2025). This indicates that official enterprise adoption figures for AI in

the workplace, and considerably more so for Romania, where tech-savvy individuals coexist with low institutional adoption, are highly underestimated.

3. Research Methodology

This study employs a method of comparative analysis, whereby systematic literature reviews and secondary data analyses are combined. The most significant primary data source of this study is the Eurostat database pertaining to the ICT usage and e-commerce in enterprises (Eurostat, 2025). This Eurostat source provides uniform data on AI adoption in EU member states as of 2025. The primary data sources, in turn, are the OECD AI Policy Observatory (OECD, 2025), the (Singla et al., 2025), the Stanford AI Index (Perrault et al., 2025), and the KPMG AI in Central and Eastern Europe report (KPMG, 2025). The comparative analysis is supplemented by the analysis of TAM (Davis, 1989; Song, Qiu & Liu, 2025), the TOE framework (Tornatzky & Fleischer, 1990; Sanchez, Calderon & Herrera, 2025), and organizational readiness model (Uren & Edwards, 2023).

4. Results and Discussion

According to the latest Eurostat data (2025), there is a glaring unevenness in the integration of AI in enterprises across the European Union. Graphic 1 indicates that this variability spans from 5.21% in Romania to 42.03% in Denmark (Eurostat, 2025).

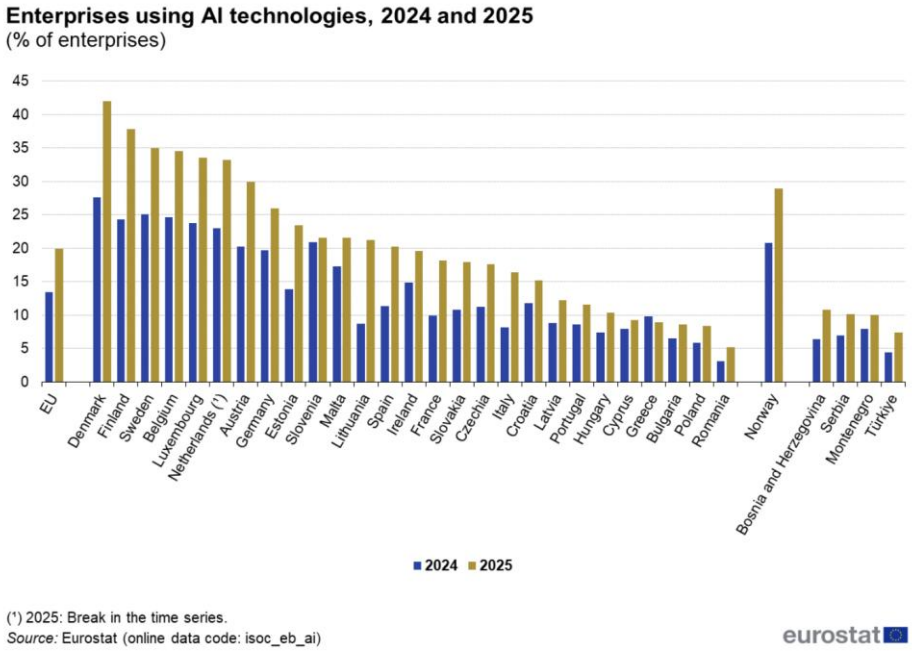
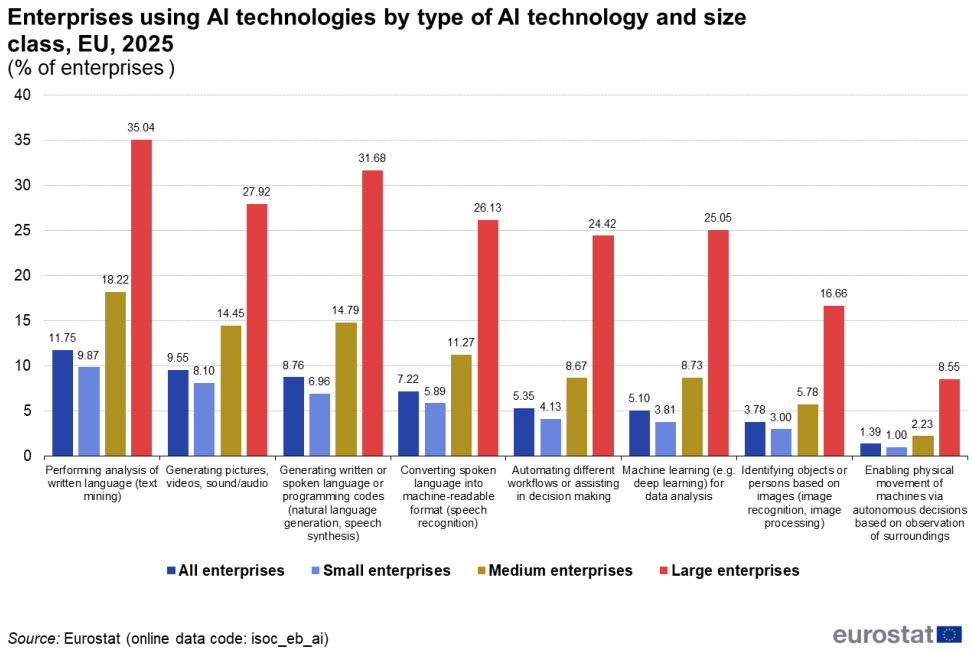


Figure 1: Enterprise AI Adoption Rates in Selected EU Member States, 2025

Source: Eurostat (2025)

Given the rapid adoption of AI technologies, the Eurostat report predicts an EU average of 19.95% by 2025 (Eurostat, 2025). Romania, with an AI penetration rate of 5.21%, illustrates an increase in AI adoption, however, the disparity in AI adoption between Romania and the EU average has increased. Eurostat 2025 notes an EU-wide consistent and strong correlation between the size of the enterprise and the adoption of AI. In Romania, where around 99.7% of businesses are SMEs (European Investment Bank, 2023), the impact of this differential is particularly prevalent. The joint CEDEFOP and Eurofound (2025) report shows that of all EU SMEs in 2024, 73% of them had achieved at least a basic level of digital intensity.



Source: Eurostat (online data code: isoc_eb_ai)

eurostat

Figure 2: Enterprises Using AI Technologies by Size Class, EU, 2024 and 2025.
Source: Eurostat (2025)

Table 1 consolidates Romania's digital standing within the European Union and the key factors related to the AI adoption gap for the country. The data shows Romania's underachievement in multiple areas. Romania's basic digital skills coverage is at 27.7%, nearly half of the EU's average of 55.6%. The share of ICT specialists in total employment is at 2.6%, which is also below the EU average of 4.8% (European Commission, 2024b). In addition, 25% of Romanian citizens use e-government services, whereas 75% of citizens in the EU do (McKinsey, 2025). These statistics exhibit an insufficient digital readiness, and this is more concerning than just at the enterprise level. While structural deficiencies and SMEs (99.7% of total enterprises in Romania) exist, and the country invests less than 0.5% of its GDP

in research and development (EU average being 2.3%), Romania's AI adoption capacity growth is severely limited.

Comparative Overview of Key Digital and AI Indicators: Romania vs. the European Union (2024-2025)

Table 1

Indicator	Romania	EU average
Enterprise AI Adoption Rate (2025)	5.21%	19.95%
Basic Digital Skills Coverage	27.70%	55.60%
ICT Specialists (% of employment)	2.60%	4.80%
SMEs as % of Total Enterprises	99.70%	99%
E-Goverment Usage	25%	75%
R&D Expenditure (%of GDP)	0.5%	2.43%

Source: Author compilation based on Eurostat (2025), European Commission (2024b), European Investment Bank (2023), McKinsey (2025)

The projected 2025 EU average of 19.95% shows the rapid speed of AI diffusion (Eurostat, 2025). With Romania standing at a rate of 5.21%, this still shows slight improvement; however, the disparity between Romania and the EU average has increased. A positive correlation between AI adoption and company size has been established within the EU. As shown in graphic 2, the adoption rate of AI by large companies (55.03%) is more than three times higher than that of small companies (17.00%) (Eurostat, 2025). Given that in Romania 99.7% of companies are SMEs (European Investment Bank, 2023), this is particularly concerning.

The most frequently mentioned obstacle to AI implementation in Romania is the lack of digital skills. On the European Commission's Digital Skills and Jobs Platform, Romania's coverage of basic digital skills is at 27.7% and the EU average is 55.6%. Additionally, Romania lags behind the EU in the employment rate of Professional IT staff, which fell from 2.8% in 2023 to 2.6% in 2024, when the EU average is 4.8% (European Commission, 2024b). Romania is one of the fastest-growing countries in the EU's information and communication technology (ICT) sector with the country's estimated 212 000 software engineers, the technology sector's contribution to GDP 6.2% of (N-iX, 2026; Alcor, 2025) and projected software services revenue of USD 507 million by 2025. However, much of the country's talent is focused on outsourcing to foreign countries instead of developing local AI capabilities.

Organizational readiness is restricted as a result of poor digital literacy among managers and the insufficient state of internal processes (Uren & Edwards, 2023). Romania, having only 25% of citizens using e-government services as of 2024, is trailing the EU average of 75%. This demonstrates a more systemic issue and a lack of digital readiness (McKinsey, 2025). A significant milestone has been reached with the EU AI Act (Regulation EU 2024/1689) coming into effect in 2024 (European Commission, 2024). The AI Act presents compliance requirements and strategic opportunities for Romanian businesses, as it likely lessens regulatory

ambiguity for public entities, which has been the case for most private companies (Neumann, Guirguis, & Steiner, 2024). While Cors and Thiébaut (2025) acknowledge that the compliance burden may put smaller businesses at a disadvantage, they argue that the resulting trustworthy AI ecosystem can stimulate innovation and increase confidence among consumers. As Axinte et al. (2025) noted, businesses remain particularly concerned about the safe use of AI.

5. Conclusions

This paper presents a systematic comparative study on AI integration in Romania and the European Union. The findings show that Romania displays an enterprise AI adoption rate of 5.21%, which is the lowest adoption rate in the EU. Additionally, Romania's enterprise AI adoption rate represents a number that is almost four times smaller than the EU average of 19.95% (Eurostat, 2025). Romania's barriers to enterprise AI adoption are multi-faceted and can be attributed to deficiencies in the area of human capital there exists a digital skills coverage of 27.7%, which is significantly lower than the 55.6% coverage in the EU (European Commission, 2024) organizational barriers, and the absence of adequate technological infrastructure. The EU AI Act establishes new legal obligations and offers new opportunities, and may act as a momentum for adoption as a result of the "Brussels Effect" (Bradford, 2020). The case of shadow AI (Sweep, 2025), indicates that the real employment of AI tools by Romanian workers may be operating on a much higher level than the employment of AI tools at the workplace as the individual workers level of preparedness far exceeds the level of preparedness of the respective organization. Several policies can be developed from the findings. Firstly, Romania should center from being an outsourcing AI labor provider, to a product-based AI economy that keeps and utilizes its considerable technical talent domestically. Secondly, digital education must be prioritized, and education on AI should be offered as part of the curriculum in ALL faculties of the university, and not just in Computer Science. Thirdly, increased and specific support for SMEs, which make 99.7% of businesses in Romania, is crucial, and this should include easier access to European Union (EU) funds and specific programmes on AI adoption. Finally, there should be a framework for formal governance of AI in organizations to ensure that informal adoption of AI is structured and safe, as well as utilized for productive purposes.

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