ARTIFICIAL INTELLIGENCE AND ITS ECONOMIC CHALLENGES IN EU COUNTRIES: IMPLICATION FOR THE REPUBLIC OF MOLDOVA

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Abstract: This article aims to determine the future influence of AI on the Moldovan economy. The relevance of this research topic derives from the European Commission's decision to launch the European AI Strategy as early as 2018, with fundamental objectives related to the adoption of AI throughout the economy, in both the public and private sectors. The strategy also aims to prepare society for the transformations brought about by AI, and to oversee the functioning of an appropriate ethical and legal framework that responds to the EU's vision regarding technological values.
Global projections also estimate that, by 2030, around 70% of businesses will use at least one artificial intelligence technology, such as computer vision, natural language processing, virtual assistants, automation/robotics and machine learning. It is estimated that this technology will generate an additional annual increase in global GDP of around 1.2%, with disruptive effects on countries, businesses and the labour market. This makes the topic of this research a global issue of high timelines.
The research method is a comparative approach to the benefits of AI and the risks it may generate. Synthesis and inference, as well as scenario building based on factual data and a pragmatic approach that respects realism and the possibility of anticipating disruptive actions.
The research will quantify the impact of AI on the structure of the Moldovan economy and the new business models it will generate, as well as the problems that may arise in connection with it. The research will also identify how the labour market of the Republic of Moldova will change in the context of EU integration and assess the current preparedness for the implementation of EU strategies in the field of AI.

*Keywords***:** *Development economy, technology change, innovative development, labor market*

JEL Classification: O1, O2, O31

1. Introduction

Artificial intelligence (AI) is becoming increasingly prevalent in the world around us. It is not only the key technology of the digitisation process, but also the main disruptive factor in our world. Intelligent machines now operate using high-level cognitive processes such as thinking, perception, learning, problem solving and decision making. There have also been advances in data collection and aggregation, computational processing and analysis power, sensor technology and robotics. AI also presents opportunities to augment human intelligence, significantly improving the way we live and work.

AI has become a strategically important area with the potential to drive economic development. It also has a wide range of social implications. At EU level, the European Commission presented a European AI strategy in April 2018 in its Communication 'Artificial Intelligence for Europe (COM.2018).

The objectives of the European AI strategy announced in this communication are:
- strengthen the EU's technological and industrial capacity and the adoption of AI across the economy by both the private and public sectors
- prepare for the socio-economic changes brought about by AI
- ensure an appropriate ethical and legal framework.

Subsequently, in December 2018, the European Commission and Member States published a 'Coordinated Plan on Artificial Intelligence', COM (2018), on the development of AI in the EU.

Taking this into account, the article aims to conduct a pre-emptive analysis of the economy's readiness, as well as assessing the future influence of AI.

2. Literature review

AI is an increasingly debated topic (Kaplan and Haenlein, 2020). One of the main topics of debate related to AI concerns the extent to which users trust and accept AI (Hengstler et al., 2016). While several authors emphasise the importance of initial trust in these new technologies (McKnight et al., 2002; Lee and See, 2004), others focus on how to integrate them into individuals' everyday work (MacVaugh and Schiavone, 2010). For example, consumers are much more willing to accept banking robots than smart cooking or legal advice devices. One of the main topics of debate related to AI is the degree to which users trust and accept AI (Hengstler et al., 2016). Several authors emphasise the importance of initial trust in these new technologies (McKnight et al., 2002; Lee & See, 2004), as well as how to integrate them into individuals' everyday work (MacVaugh & Schiavone, 2010).

The impact of these advancements is evident in various domains, including medicine (Holzinger et al., 2019), finance (Bahrammirzaee, 2010; Königstorfer & Thalmann, 2020), agriculture (Bannerjee et al., 2018), self-driving vehicles (Tong et al., 2019), robotics (Vrontis et al., 2022) and social media (Ozbay & Alatas, 2020). In a matter of months, companies have shifted their corporate approach towards AI-related projects. This shift is highlighted by the increasing number of references to AI in earnings reports, which often come at the expense of Environmental, Social and Governance (ESG) considerations (Patnaik & Vlastelica, 2023; Goodkind, 2023b). Google, Microsoft and Meta have accelerated the development of their AI products, Bard, Bing and LLaMA respectively (Wangsa, Shakir et. all, 2024), and the increased demand for AI chips has seen Nvidia reach a significant market capitalisation milestone of $1 trillion on Wall Street (Goodkind, 2023a).

The 'Dutch AI Manifesto' (2018) outlines the significant impact of AI on key business areas and recognises the need for substantial investment in the development of robust AI systems. It also places a strong emphasis on research, innovation and education. From this literature, we can deduce that the impact of AI has been researched in various areas and on the effect of these technologies on some economic sectors in developed countries. However, there has been no research into the effect of AI on less developed economies or their readiness. Currently, however, there is a significant disparity between developed and less developed economies. If this situation does not change, there is a risk that we will remain a less developed economy for the foreseeable future.

3. Research metodology

The research methodology employed in this study integrates a comparative analysis within the European Union framework, focusing on both the potential benefits and inherent risks associated with artificial intelligence, as well as the broader economic disparities. We applied techniques of synthesis and logical inference, alongside the formulation of strategic directions grounded in empirical evidence and guided by a pragmatic lens. This approach remained anchored in a realist perspective, incorporating the capacity to anticipate possible disruptive developments. Through this analytical framework, we assessed the prospective impact of artificial intelligence on specific sectors of the Moldovan economy. In particular, we examined anticipated transformations in the labour market structure of the Republic of Moldova in the context of EU integration and evaluated the country’s current level of institutional and policy preparedness for the implementation of relevant EU strategies in the field of AI.

4. Research area

Based on the existing statistical data we made an analysis of the possible effect that AI could have on the Moldovan economy. Taking as a benchmark the findings of a McKinsey study that estimates AI has the potential to provide additional global economic activity of about $13 trillion by 2030, or about 1.2 percent additional growth per year. However, a 2019 McKinsey study warned that "Europe is adding an AI gap to its digital divide"; European companies lag behind their US counterparts in adopting big data architecture and advanced machine learning techniques that underpin AI. If we consider the trends in the EU market, by 2030 at least 75% of EU businesses will use cloud technology, AI and big data, and at least 90% of SMEs will have a basic level of 'digital intensity'. Taking this into consideration, we can also note legally that the economy is not oriented towards the implementation of AI, nor is there any strategy regarding its use, despite such a strategy existing not only at the EU level, but also in neighbouring countries such as Romania, which has already made a much more significant leap in this direction.

It is also worth noting that the current focus is on the ICT sector, which has become the main driver of digitalisation and innovation in Moldova and is growing rapidly. In 2021, the IT industry accounted for over 4.2% of gross domestic product (GDP), with sales exceeding 10 billion lei. The ICT sector accounted for over 7.6% of GDP, with sales of over 18 billion lei in 2021, generated by around 2,000 companies employing over 30,000 people. According to the NBM report for 2022, the export of ICT services reached USD 501.85 million. IT exports have grown by more than 30 percent annually over the last five years, reaching a record level of 468.67 million USD in 2022.

Based on existing statistical data, we analysed the potential impact of AI on the Moldovan economy. We took the findings of a McKinsey study as a benchmark, which estimates that AI could provide an additional $13 trillion of global economic activity by 2030 — equivalent to an additional 1.2 percent growth per year. However, a 2019 McKinsey study warned that 'Europe is adding an AI gap to its digital divide'; European companies are lagging behind their US counterparts in adopting the big data architecture and advanced machine learning techniques that underpin AI.

In fact, general presentations on the state of AI often don't present Europe as a player, nor do they consider some European countries. This could be due to language barriers and the large number of European states, but it also indicates a lack of interest in this subject from the EU and its Member States, as well as a lack of funding for such studies. When assessing a country's AI capabilities, both the 'outputs/outcomes' and the 'inputs' should be analysed. Outputs are the actual AI capabilities and can be measured in terms of, for example, the number of AI firms or the level of AI usage by businesses. However, as important advances are made in machine learning and other AI techniques, it is equally important to study the key factors influencing AI development, as this may provide insight into future trends.

A 2020 survey found that only one to three percent of EU businesses with ten or more employees use AI, such as machine learning, natural language processing or speech recognition (excluding the financial sector). Considerable differences exist between European countries: 20% of Irish companies and 12% of Maltese firms report analysing large volumes of data internally using machine learning, compared to 5% in Denmark, 2% in Germany, France and Italy, and 1% in Greece, Latvia and Poland. However, the divergence is not as pronounced for techniques such as language processing.

5. Results and Discussions

Taking these factors into account, we have created a forecast based primarily on the total number of employees, broken down by sector. AI will also be implemented by companies because it has a positive impact on labour productivity and the potential replacement of some workers. This will affect some sectors more than others, but it will certainly impact the entire economy.

Table 1. Number of employees in the Republic of Moldova in 2023

Average number of employees (full-time equivalent), persons	623 600
Share service sector, %	57.6
Share in manufacturing, %, in	12.2
Share in industry, %, %, in manufacturing	14.4
Share of employees in construction, %, %, in industry	7.1
Share of agricultural sector in average number of employees, %	20.8

Source: Elabored by the author based on data from the National Bureau of Statistics of the Republic of Moldova.

Other criteria that we considered when drawing conclusions were the recorded economic situation, including the fact that the number of employees has decreased, although the largest decrease was in construction, which may be related to the season. However, there has been a downward trend in the number of employees in both manufacturing and trade.

Table 2. Trends in economic activity by type of activity in Q1 2024

	Manufacturing	Construction	Retail trade and services
Economic situation	-8.8↘	-5.4 →	+0.8 →
Sales revenue	-13.7 ↘	-13.6 ↘	-4.3 →
Number of employees	-1.6 →	-2.9 →	-1.2→

Source: Elabored by the author based on data from the National Bureau of Statistics of the Republic of Moldova.

We have observed a decline in the number of enterprises in the Republic of Moldova. The main causes are a lack of market demand (low market capacity), which accounts for about 30% of cases, a lack of skilled labour (23%), and a lack of financing sources (21%). Considering that AI could replace at least part of the labour force, we are already witnessing this phenomenon, where some jobs are being replaced. This would increase labour productivity and reduce costs in the coming years. While all these factors would certainly lead to increased economic competitiveness, they would also raise significant social issues, particularly for older and less qualified people. Another critical challenge identified concerning the prospective implementation of artificial intelligence is the shortage of qualified personnel and researchers capable of laying the foundational groundwork. The statistical data unequivocally illustrate this deficit.

Table 3. Number of research/innovation employees

	Persons			
	2021		2022	
	Total	including women	Total	including women
Total	**4 157**	**2 150**	**3 889**	**2 023**
researchers	2 920	1 459	2 809	1 429
technicians	245	172	173	125
auxiliary staff	561	291	430	248
other categories of employees	431	228	477	221

Source: Elabored by the author based on data from the National Bureau of Statistics of the Republic of Moldova.

We estimate that, in the near future, the distribution of PhD students by scientific field will reveal a slight increase in the share of social and economic sciences (50.7% in 2022 compared to 50.3% in 2021). The fields of medical and legal sciences attract the highest number of students (21.4% and 17.6%, respectively), followed by economic sciences (12.4%) and humanities (11.9%). Other scientific fields are less represented among doctoral students, particularly agricultural sciences (2.7%) and military sciences and intelligence (0.8%).

Another hypothesis we discussed was investigating the perception among employees in various sectors of the need for innovation. To this end, we developed a survey involving employees from 27 companies and 4 banks in the Republic of Moldova. We would like to draw the following conclusions from the results:Out of the total number of those interviewed, approx.31.5% had worked in their current role for more than five years, 28.8% for one to three years, and 26% for three to five years.13.7% with up to 1 year's experience. Of those surveyed, 47.9% belong to enterprises with up to 30 employees, 27.4% to enterprises with more than 500 employees and 9.6% to enterprises with 51–100 employees. Of those surveyed, 61.6% work in the service sector, 28.8% in financial banking and manufacturing and 9.6% in agriculture. When asked how motivated employees are to contribute new ideas, 77% of respondents indicated that they are motivated and 23.3% indicated that they are not. When asked how often the management team communicates innovation needs or what innovations they have introduced, over 77% of respondents gave a positive answer and 17.8% gave a negative answer. When asked how much their organisation collaborates with others in the same value chain, 70% said yes and 20.5% disagreed. The key finding is that employees have a higher level of awareness of the need for innovation than government decision-makers do. This indicates a discrepancy between what we want and what society wants.

So, we are also in a difficult situation. We can see that there are many obstacles to overcome. For now, we need to identify these obstacles and develop a strategy to address them. The areas that will develop successfully in the coming years will certainly be technology-based. They will transform the economic landscape of the world and its countries.

We also believe that it is worth paying attention to some philosophical approaches to technology in general. Technology 'just opens a door; it doesn't force someone in'. This is a compelling metaphor. It

encapsulates the viewpoint known as 'technological voluntarism', which is the opposite of technological determinism. Technology only presents an opportunity; the choice of what to do with it remains ours. However, while this view contains an element of truth, it ultimately seems incomplete.

Following the metaphor of open doors, Kranzberg also highlights the inadequacy of a view that focuses narrowly on the initial decision to use or not use a technology. Many of our problems with technology arise from the unintended consequences of seemingly benign technologies being widely used.

Tortoise Media's global AI rankings rank countries based on implementation, innovation, and investment, providing an aggregate score that may combine output and input measures. Three EU countries are in the top ten (Germany, the Netherlands and France), 15 are in the top 30 and 22 are in the global top 50. Some countries are leaders in various areas — for example, in terms of operating environment, EU countries top the list, with Poland, Slovenia, Lithuania and Slovakia in the top five. Notably, the UK has the highest score of any European country in this ranking, placing third after the US and China.

In order to prepare for these AI challenges, three elements are crucial: the so-called 'AI Triad' of talent, data and computing power. Talent is clearly the most important factor. In fact, economic power will be dictated by a 'battle for talent'; whoever 'wins' will have world supremacy in AI. There are also a number of pillars underpinning these ecosystems that need to be identified, activated and leveraged in an interconnected way.

6. Conclusions

Technology today is inherently geopolitical, with artificial intelligence emerging as a critical factor in the strategic competition among major global powers. This reality poses significant challenges that the European Union and its Member States must urgently address. AI is poised to reshape the global balance of power, redefine interstate relations, and impact geopolitics at large. Consequently, the EU must respond proactively by implementing necessary reforms, taking into account not only its internal policies but also the external implications of its actions, including its relationships with allies, partners, supportive states, and rivals.

While there are avenues for the EU and its Member Sates to confront these challenges, many European countries have yet to initiate substantial efforts in this direction. It is imperative that Europe commits greater time, resources, and financial investment to harness the opportunities presented by AI on the international stage while effectively managing its risks.

This transition demands that numerous European countries, particularly economies such as the Republic of Moldova, reevaluate their business models, restructure workflows, and rethink educational frameworks to capitalize on technological advancements. Such a transformation requires significant investments in research, education, and IT infrastructure, supported jointly by public funding and private enterprises. Furthermore, a comprehensive overhaul of education is essential, including the development of lifelong learning programs for adults. Instead of narrowly focusing on applied technical skills prone to rapid obsolescence, educational strategies should emphasize cultivating young people’s capacity for adaptive learning.

Building upon these foundations, AI systems must adhere to seven fundamental principles: human involvement and oversight; technical robustness and safety; privacy and data governance; transparency; diversity, non-discrimination, and fairness; social and environmental well-being; and accountability. Compliance with these principles necessitates both technical and non-technical approaches, with developers bearing primary responsibility for their assessment and implementation. Moreover, addressing these principles presents ongoing challenges for research and innovation, underscoring the urgent need to train a new generation of experts in AI and AI ethics.

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