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LIMITS AND OPPORTUNITIES OF ARTIFICIAL INTELLIGENCE IN THE REPUBLIC OF MOLDOVA

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Abstract: Artificial intelligence and its related elements represent a major challenge for the global economy. The Republic of Moldova, being a young state, with a developing economy in the process of European integration, is even more interested in the advantages and challenges that technology and artificial intelligence bring. In this paper, the authors propose to analyze the challenges faced by this field in the Republic of Moldova and which are the areas that need the implementation of AI as a catalyst in their development. Today, the Republic of Moldova faces two main challenges: the war in Ukraine and its negative consequences on our country's economy and security and the significant effort to align with European standards in the current harsh conditions. In this context, we believe that the correct implementation of artificial intelligence technologies are useful in terms of avoiding errors, stopping fake news, propaganda, increasing the productivity of the human factor and improving the business environment. Considering that just some years ago, the majority of the country's population was completely unfamiliar with the term artificial intelligence, today, implementing it is a challenge and a necessity, aiming to grow and develop the country.

Keywords: Artificial intelligence, security, technologies, tools

JEL Classification: O3, O5

1 Introduction

In recent years, the world's economies have undergone radical transformations that have changed not only the level of economic development but also visions, concepts, and mentalities. It happened due to several factors, but the decisive one we consider is technological change with all its related elements. The speed at which AI technology is developing is astonishing. For example, ChatGPT was launched in November 2022. Four months later, OpenAI released a new large language model, or LLM, called GPT-4. In May 2023, Google announced several new AI-powered features, including Search Generative Experience and a new LLM called PaLM2 that powers the Bard chatbot. It is considered that the potential of artificial intelligence is so great that its use will unlock and generate trillions of dollars in national economies (Mckensey, 2023) That is why, in this article, the author aims to analyze how artificial intelligence technology has revolutionized the world and why it is an indispensable phenomenon in all economies, including the Republic of Moldova.

It is essential to present some theoretical notions of this concept to analyze the limits and opportunities of artificial intelligence (AI) in all its spheres of action. It is good to distinguish between human intelligence, the brain's ability to create something, and the human being's ability to invent or innovate. At the same time, Artificial Intelligence tries to imitate human abilities through various

machines and technologies. In other words, AI is the ability of machines and technologies to perform computing, storing, planning, and problem-solving functions instead of humans. Over the years, the replacement of manual labor with artificial intelligence has brought a string of benefits in all aspects of life, starting from increasing labor productivity and competitiveness, which in turn have generated economic growth, and ending with easing daily human activities, transportation, travel, remote connectivity, studies, and education.

The father of AI is considered to be Professor John McCarthy, one of the organizers of the Dartmouth research project in 1956, which gave birth to AI as a specific field and defined "AI" as "the science and engineering of creating intelligent machines" (McCarthy, 2007). Thus, computers and artificial intelligence have gone hand in hand and totally changed our world. Even if the history is short, the effects are enormous. Figure 1 shows the evolution of computer technology and how quickly things have changed, as the phone model created two years ago already seems outdated.

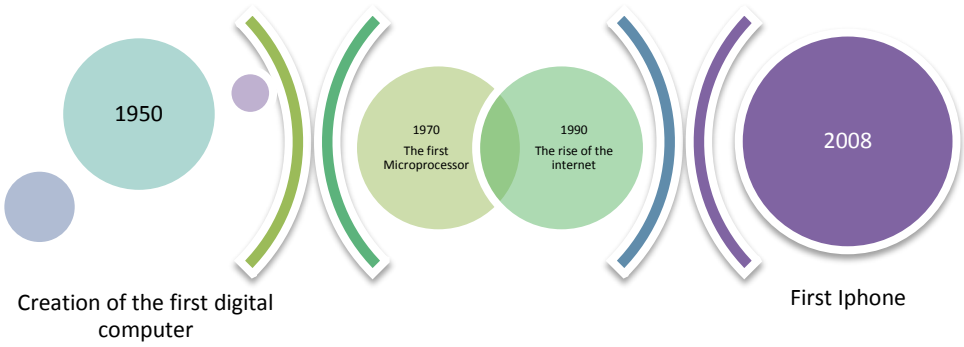

Figure 1: Chronological development of computer technology
Source: authors own study

Analyzing the connection between computers and artificial intelligence, some computer scientists have strived to make machines as intelligent as humans from the very beginning. Figure 2 shows the chronological evolution of artificial intelligence (AI) systems and their role in humankind.

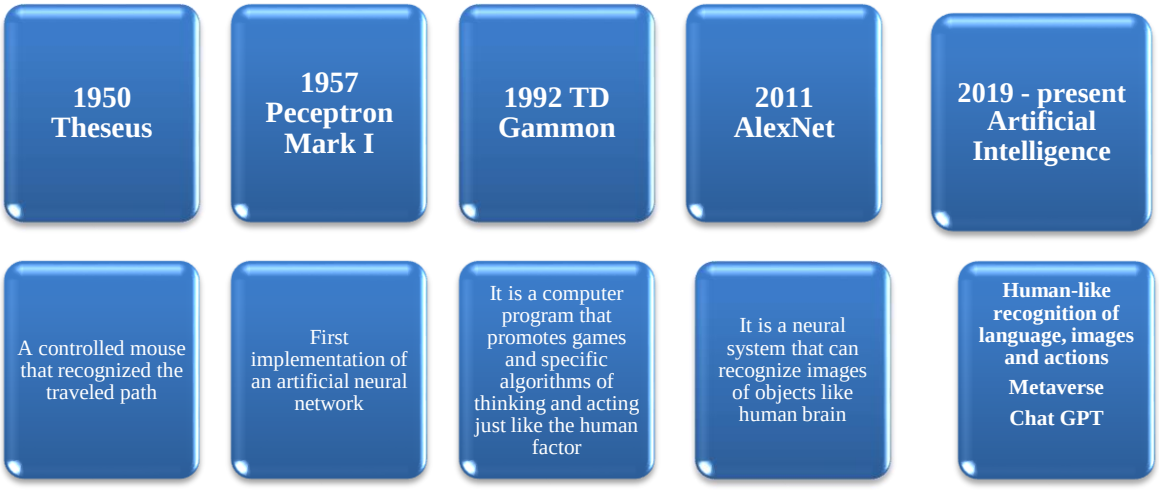

Figure 2. Chronological development of artificial intelligence systems
Source: authors own study

The first system is Theseus. It was built by Claude Shannon in the 1950s as a remote-controlled mouse that could find its way out of a maze and remember its course. In seven decades, artificial intelligence's capabilities have changed constantly, with extraordinary effects on all aspects of life. While the early systems focused on generating images of faces, these newer models have extended their capabilities to generate text images based on almost any request. There are programs that turn images into text in seconds or vice versa, recognize voices, identify any information you need, do market research in a short time compared to a survey physically done by an individual, solve problems, edit summaries, etc.

What we have presented above is only a micro part of this complex system. The cooperation between the development of technology and artificial intelligence is strongly connected because the more sophisticated these machines are the better the software and AI elements work, such as Minerva program (solves problems at the university level), PaLM (elaborates sophisticated texts), Chat GPT, DALL-E (images with text description), NEO (setting viewing preferences in social networks), etc. (WEF, 2022) The fact is that artificial intelligence is in the process of development and more complex programs will emerge. The European Commission suggests in various reports that Artificial Intelligence (AI) is considered a "defining technology of the future." (EC, 2020)

1. The advantages, limits, and opportunities of artificial intelligence in the world's economies

As previously mentioned, artificial intelligence is indispensable in the evolution of any economy, regardless of its level of development. According to International Monetary Fund (IMF,2024) estimates, artificial intelligence is poised to reshape the global economy. On the downside, it could threaten 33% of jobs in advanced economies, 24% in emerging economies, and 18% in low-income countries. On the positive side, however, it has enormous potential to increase the productivity of existing jobs, for which AI can be a complementary tool, and to create new jobs and industries. Most emerging market economies and low-income countries have a lower share of high-skilled employment than advanced economies. Therefore, they are likely to be less affected by AI and face fewer immediate disruptions. At the same time, many of these countries do not have the infrastructure or skilled workforce to capitalize on AI's benefits, which could exacerbate inequality between nations. Meanwhile, artificial intelligence is already an everyday reality for consumers, businesses, and governments globally. As one of the most transformative technologies, artificial intelligence is helping users reach new levels of creativity, productivity, and effectiveness. A recent survey indicated that two-thirds (67%) of IT leaders prioritize AI for their business, and one-third (33%) consider it a top priority. Similarly, 72% of companies surveyed say they will significantly increase their investment in AI in the coming years. (WEF, 2023)

According to Goldman Sachs Research (GDS, 2023), breakthroughs in generative artificial intelligence can potentially bring radical changes to the global economy. As tools that utilize advances in natural language processing make their way into businesses and society, they could drive a 7% (or nearly $7 trillion) increase in global GDP and boost productivity growth by 1.5% over the next ten years. Despite the significant uncertainty about artificial intelligence's potential, its capacity to generate content reflects a major breakthrough with crucial macroeconomic effects.

We aim to analyze several important sectors of national economies that are directly influenced by AI development:

- ***The role of artificial intelligence on business impacting the economy*** – In recent years, the business community has increasingly realized the importance of technology in accelerating company growth and development, which in turn generates economic growth. Artificial intelligence is successfully used in many segments of companies, such as sales, marketing and promotion, product creation and design, research and development, human resource management, accounting and analysis, and planning and control. For example, applying AI in marketing to generate creative content, such as personalized emails, social media posts, and promotional content in various environments, can automatically create cost savings for companies. The Mckensey Company conducted a study on several companies that found that using 63 programs from AI covering 16 jobs could generate a total value of between $2.6 trillion and $4.4 trillion annually when applied across industries. Overall, they estimated that artificial intelligence could generate between 9.5 and 15.4 trillion dollars in global GDP. The study also emphasized that the widespread use of AI in various industries could perform "detailed work tasks" such as "communicating with others about operational plans or activities." It would significantly enhance productivity growth and company competitiveness. (Mckensey, 2023)
- ***The impact of artificial intelligence on the labor market*** – According to several studies, AI can stimulate growth by replacing labor as a scarce resource with capital, which can be considered an unlimited resource for producing goods, services, and ideas. Studies have revealed that up to 300 million jobs worldwide could be affected in the coming years. AI could automate 25% of the entire labor market. Economists at the American Investment Bank predict that AI will replace humans in 46% of administrative tasks, 44% of legal jobs, and 37% of architectural and engineering professions. The effects will likely be felt more in advanced rather than emerging economies. (Trabelsi, 2024) The difference between countries reflects various reasons: the time it takes to integrate technological capabilities into solutions that can automate individual work activities, the cost of these technologies compared to the cost of human labor in different occupations and countries around the world, and the time it takes to spread the technologies throughout the economy. All this depends mainly on the decisions that will be taken on investment, deployment, and regulation;
- ***Artificial intelligence and education*** – If used correctly, artificial intelligence (AI) can potentially transform education. With its help, it is accelerating the transition to Education 4.0, a future-oriented teaching and learning framework that delivers the skills, attitudes, and values essential for the future. To unlock the transformative potential of these technologies to improve learning outcomes, Education 4.0 focuses on four key strategies: generating high-quality information and tools, engaging influential education leaders, mobilizing the global education industry, and accelerating strong national public-private partnerships. (WEF, 2024) Concrete methods used by AI in education are: educational chatbots, virtual assistants for teachers, automatic translation and interpretation systems, etc. (for example Grammarly, DeepL, Duolingo, Coursera, Knewton).

How can we identify the limits or advantages of using artificial intelligence in the world's economies, including Moldova? There are several specific criteria, and depending on their level of development, we can deduce the degree of utilization of artificial intelligence. The following aspects determine the level of readiness of countries to use it:

- *Digital infrastructure* – as mentioned in Figure 1, artificial intelligence develops together with compatible technical resources and hardware. Determining the compatible technical infrastructure needed for intensive processing is the first step toward preparing for AI;

- *Data* – AI models require large amounts of data to generate realistic content. Building a solid base of quality data is essential to generating relevant results;
- *Workforce development* – Artificial intelligence will have implications for the workforce in all industries, yet the aim is not to replace it entirely but to enhance it. Successful AI is about enhancing – not replacing – the human workforce. However, there will be significant demand for AI skills. Government and business must invest in human talent and skills;
- *Ethics* – While generative AI has the potential to profoundly change the way we live and work, it is not without risks. There are ethical concerns, such as the potential for biased or harmful content. It is important to prioritize responsible and ethical innovation from the outset.

The analysis of the AI Preparedness Index (AIPI), a study conducted by the International Monetary Fund in 174 countries, based on a complex set of indicators such as countries' digital infrastructure, human capital and labor market policies, innovation and economic integration, and regulation and ethics, found that the countries with the highest preparedness in the use of AI are developed countries, with an index of 0.68 out of 0.8, emerging countries rank at a level of 0.46, while the less developed ones around 0.32. The gaps are evident, as underdeveloped countries face considerable difficulties in their digital infrastructure due to a lack of innovation, lack of internet access, weak digital skills of the population, vulnerability, weak security, etc.

2. The necessity of using artificial intelligence in the Republic of Moldova

Starting from the idea that the Republic of Moldova is a developing country with a GDP per capita of approximately 5000 dollars, according to UNCTAD data for 2023, and according to the AI Preparedness Index (AIPI) 2023, developed by the IMF, the Republic of Moldova has an index of 0.48 out of 0.8, classifying it in the low-income countries category, it is clear that the use of Artificial Intelligence is a necessity, but it comes with several challenges. Although the Republic of Moldova signed the Council of Europe Framework Convention on Artificial Intelligence, Human Rights, Democracy, and the Rule of Law on September 5, 2024, in Vilnius, our country is at an early stage in this field, being obliged to create a solid national framework of regulations and policies for artificial intelligence systems. For the Republic of Moldova, using artificial intelligence elements would bring significant advantages to the labor market by replacing employees in various sectors, especially agriculture, which can be transformed into an intelligent and highly productive one. Artificial intelligence would help the government and its subordinate institutions manage public policies more effectively. At the same time, being a vulnerable country in terms of security, with a border war, the innovative elements of AI would allow the identification of false alerts and prevent information risks and cyber-attacks. Furthermore, the widespread use of artificial intelligence in the business environment would increase the export competitiveness of Moldovan products, especially in the current conditions of being a candidate country to the European Union, and this would increase the visibility of our country on the world market, which would lead to long-term and sustainable economic growth.

However, what difficulties does the Republic of Moldova face in implementing elements of artificial intelligence compared to developed countries? There are several aspects mentioned here:

- The average low incomes of the population, while we know that software, support programs are quite expensive;
- Low human digital skills in innovative technology;

- In schools, universities, vocational training programs in this field are only at the initial stage, or are missing entirely;
- Lack of qualified employees in the field of artificial intelligence, which needs people to manage data, algorithms, processes.

In order to increase the use of artificial intelligence in the Republic of Moldova, it is necessary for the state to realize the added value that this sector can generate. This will encourage the business environment through various policies to widely implement innovation and elements of artificial intelligence, which are so complex and can increase labor productivity and competitiveness..

Conclusion

In conclusion, we can say that artificial intelligence is a phenomenon that cannot be stopped as it continues to shape the world at an enormous speed. Even if it brings various drawbacks, it is time to turn them into opportunities. Artificial intelligence must be approached as something that enhances rather than reduces, as something that improves rather than excludes. To extract the maximum benefits from artificial intelligence, it is necessary to cultivate a strong learning system based on developing the analytical, synthesizing, creative, and inventive skills of Generation Z, Alpha, as they are the most ready to embrace innovation in all spheres of life.

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