

MATHEMATICAL METHODS, MODELS AND INFORMATION TECHNOLOGIES IN ECONOMY

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SYNERGY OF AI AND BUSINESS AS A FACTOR OF MANAGEMENT EFFICIENCY IN THE CONTEXT OF TECHNOLOGY DEVELOPMENT

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Introduction. In the face of global challenges and current circumstances, artificial intelligence (AI) continues to evolve and adapt, providing new opportunities for technological advancement and contributing to the transformation of various areas of life. For example, the recent release of ChatGPT-3.5 has significantly increased public interest in AI. Thanks to its convenience and seemingly impressive awareness, this technological tool has begun to penetrate everyday life.

In response to the information explosion, innovation-driven companies are actively seeking ways to use AI as a catalyst for the development of innovative products based on this technology. In line with the trend towards the development and proliferation of artificial intelligence, emphasis is placed on the need to conduct a comprehensive study and analysis of the potential applications of AI in business. This technology holds great promise in terms of analysing large volumes of business information, optimising processes, improving productivity and gaining competitive advantage.

It is advisable to delve into the greater issues and challenges associated with the implementation of this technology in business. These include the limitations and requirements for companies intending to integrate artificial intelligence into their business processes, such as the scope of the company's activities, monitoring and reporting of its own activities, availability of the necessary databases, availability of ready-made and effective artificial intelligence tools on the market, complexity of implementation and support of these tools, as well as the cost of implementation compared to the economic benefits.

Analysis of recent research and publications. Artificial intelligence technology and the possibilities of its application in the socio-economic environment have long been studied by both domestic and foreign scientists, many of whom predicted the rapid development of this industry.

For example, Galina Mashliy, Olga Mosiy and Mariana Pelcher noted that in recent years there has been an extremely high rate of development of science, engineering and technologies aimed at developing and implementing artificial intelligence in human practice [1]. M.G. Bortnikova and Y.L. Chyrkova examined how human economic activity can be transformed by means of artificial intelligence [2].

In their study, Janusz Nesterak and Olga Malinowska concluded that in order to survive, modern companies are forced to redesign and reorganise their activities and be flexible to innovation [3].

Yuriy Kovtunencko is another domestic scientist who has studied this issue. He identified the main reasons for the necessity of introducing artificial intelligence into the management system of a modern enterprise [4]. The current state and trends of artificial intelligence development in Ukraine were also analysed by Hryhorii Haina [5].

Among foreign researchers, I would like to highlight a joint study by Ida Merete Enholm, Emmanuel Pagiannidis, Patrick Mikalef & John Krogstie, who conducted a fundamental analysis of the English-language scientific literature in an attempt to determine the value of artificial intelligence for business [6]. An important study on data analysis using artificial intelligence was carried out by Bahman Zohouri and Masoud M. [7].

Vijay Pereira, Elias Hadjielias, Michael Christofi, and Demetris Vrontis conducted a systematic review that examines the relationship between artificial intelligence and workplace outcomes. This study is based on 60 articles published in 30 leading international journals [8].

There are conceptual challenges associated with the use of artificial intelligence (AI). In particular, it is necessary to take into account the need for a significant amount of high-quality data on the basis of which AI can acquire knowledge and perform certain tasks. In addition, it is important to emphasise that even with a large data set, the guarantee of error-free operation of an AI system remains unattainable. This creates an additional challenge, namely the cultivation of distrust and prejudice towards this technology among users. These aspects are of paramount importance for understanding the nature of the challenges posed by AI and should be included in future research efforts.

Objectives of the article. The purpose of the study is to summarise information on the general and investment development of artificial intelligence in the business sphere and to formulate ways to use AI in the process of activity and functioning of enterprises.

The main material of the study. Artificial intelligence research has been going on for decades, leading to numerous definitions and interpretations of this concept. In the early stages, the perception of AI was associated exclusively with software code and mathematical algorithms. Over time, the scope of artificial intelligence has expanded, and researchers in the field have explored and formulated their own interpretations of the concept.

Given the diversity of interpretations and the recent success of AI-based language models, a view of this concept has evolved. In particular, artificial intelligence is defined as a complex computer program that can assist humans and perform tasks by using huge amounts of data and advanced language models. This approach takes advantage of general development and offers unlimited scalability.

Since this article is dedicated to the study of artificial intelligence from the perspective of economics and business, this article deliberately refrains from delving into the extensive history of this technology within the computer sciences. However, to lay the groundwork for this study, an important indicator is proposed to be considered: the amount of investment in the world's top 100 AI startups.

According to other studies in the field, the dynamics of investment in the world's top 100 AI startups can be observed since 2011, when the total investment amounted to only 25.88 million USD. Over the next six years, this figure demonstrated a significant growth, reaching 1866.6 million USD by the end of 2016 [9]. The dynamics of investments in the world's top 100 AI startups is shown in Figure 1 below. This phenomenon indicates a growing interest in investing in promising AI projects, outlining new trends in financing and creating opportunities for innovative development of the sector.

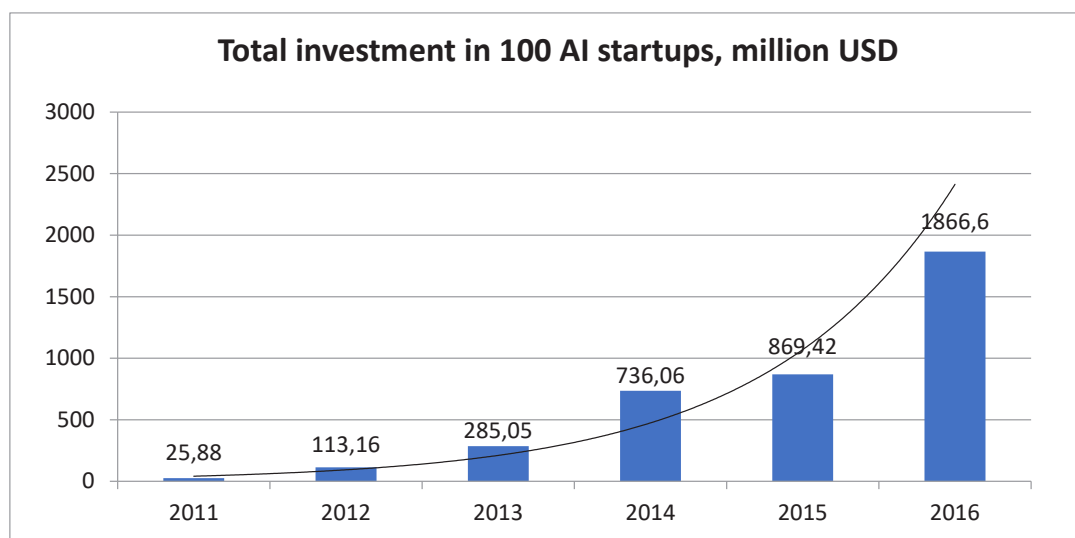


Figure 1. Investment dynamics in the world's top 100 AI startups

Source: compiled by the authors based on [9; 10]

To further analyse the level of investment in AI, this paper will refer to a study conducted by CB Insights [10], an analytical company specialising in collecting and analysing data on startups, innovative companies, technology trends and other aspects of the business ecosystem. According to their findings, investments in artificial intelligence totalled 0.6 billion USD in 2017 and will increase to 7.3 billion USD in 2021. It is important to note that these figures differ slightly from the previous study due to differences in calculations. CB Insights specifically analysed the value of the largest investment deals rather than the total value of AI startups. For clarity, these results are visually presented in Figures 2 and 3.

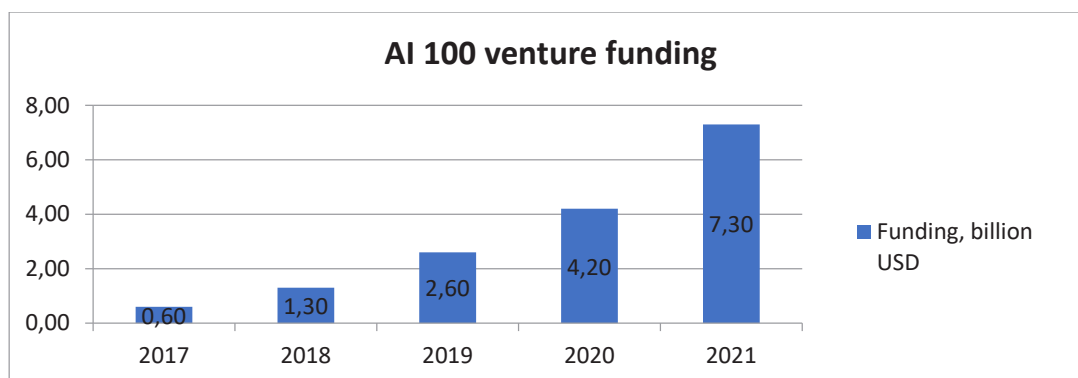


Figure 2. AI 100 venture funding

Source: compiled by the authors based on [10]

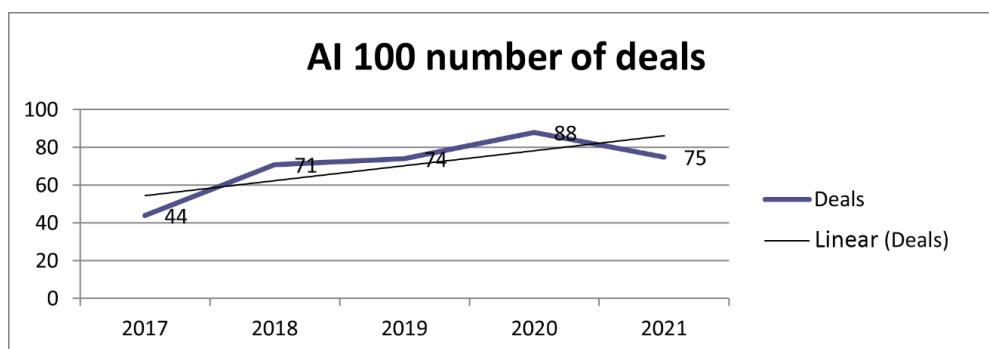


Figure 3. AI 100 number of deals

Source: compiled by the authors based on [10]

Therefore, to determine the current level of investment in the industry, it is suggested to analyse data from Statist, an online platform that provides statistics and graphs for various industries such as business, technology, consumer goods, media and others. It is one of the largest resources of statistics and data in the world. According to the data obtained from this resource, the total investment in AI startups as of the fourth quarter of 2020 was 10.9 billion USD, which helps to estimate the share of investments in the top 100 AI startups compared to the total investment in this industry. There was also a significant increase in investment in 2021 to 18.9 billion USD, a decrease in investment in 2022, and now this figure has stabilised at around 10 billion USD [11].

Thus, having analysed several scientific and statistical sources, it can be seen that since 2011, the volume of investments in the world's top 100 AI startups has tended to double annually. In the 10 years since the beginning of this observation, investments have increased from 25.88 million USD to 7.3 billion USD in 2021, and the total investment in AI startups in 2021 reached a record 18.9 billion USD.

Having studied AI as a business area, it is proposed to determine how ordinary companies can use this tool. For example, Forbes Advisor surveyed 600 business owners who use or plan to implement artificial intelligence in their businesses. The survey showed the following:

- Every fourth business owner is concerned about the impact of AI on website traffic;
- almost all (97%) business owners believe that ChatGPT will help their business;
- one in three businesses plan to use ChatGPT to write content for websites, and 44% plan to use ChatGPT to write content in other languages;

- more than half of business owners use artificial intelligence for cybersecurity and fraud prevention;
- over 40% are concerned about over-reliance on technology due to the use of artificial intelligence;
- almost half of business owners use AI to create internal communications;
- nearly two-thirds (64%) of business owners believe that artificial intelligence will improve customer relations [12].

Many scientists who have studied the use of artificial intelligence in business often assume that this technology can be useful. However, this formulation is rather generalised. Therefore, the main ways in which businesses can use AI for their own purposes have been identified and presented in Figure 4 below.

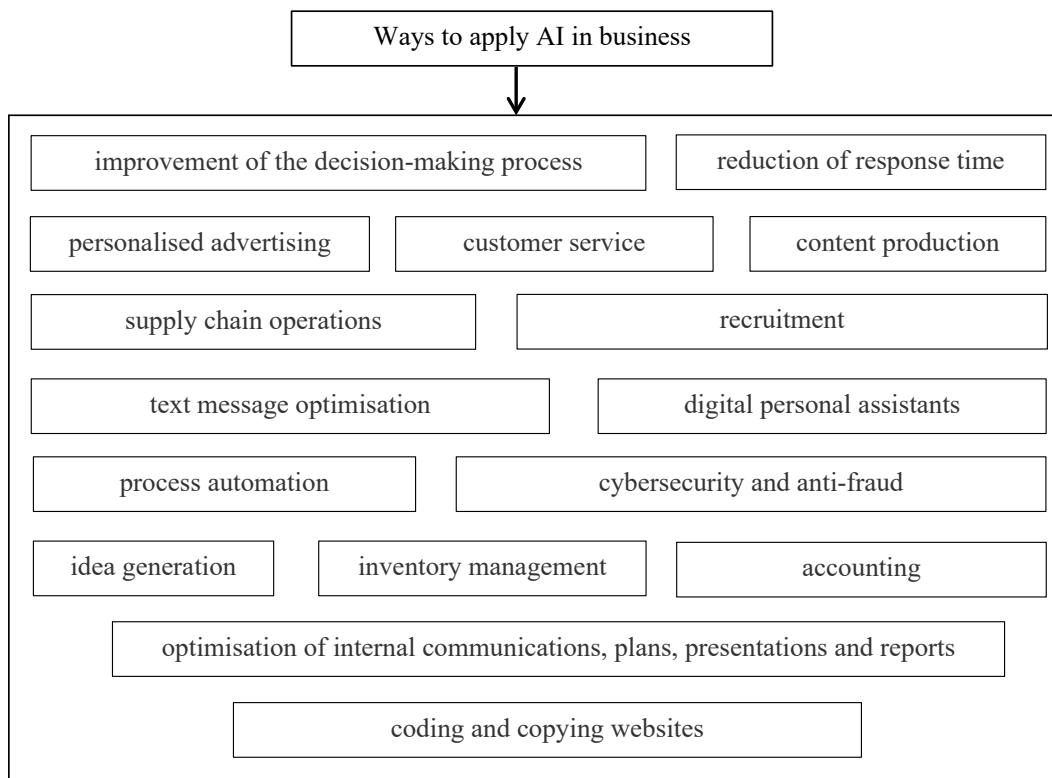


Figure 4. Ways to apply AI in the business environment

Source: compiled by the authors based on [12]

Despite the potential benefits of artificial intelligence, its implementation poses several challenges for businesses. One of the most important issues is data privacy and security. As companies collect and analyse more data, the risk of cyber-attacks increases. In addition, the use of AI can raise ethical considerations, particularly with regard to the use of artificial intelligence in decision-making. There is a risk that artificial intelligence will increase bias and discrimination if it is not carefully designed and implemented [13].

The use of artificial intelligence in business increases convenience and profitability, but also raises concerns about algorithmic social and information bias, privacy, and data protection [14].

This technology may also affect the quality of education of future employees, as students may use it unfairly.

In general, the development of Artificial Intelligence in Education (AIED) has the potential to transform the educational landscape and influence the role of all stakeholders involved. In recent years, the use of AIEDs has been gradually introduced to improve understanding of student performance and to enhance learning and experience. However, the introduction of AIED has led to increased ethical risks and concerns about several aspects, such as personal data and learner autonomy [15].

Importantly, government authorities are also aware of the threats that AI may pose, as the Concept for the Development of Artificial Intelligence in Ukraine, approved by the CMU, states that the introduction of information technologies, including artificial intelligence technologies, is an integral part of the development of socio-economic, scientific, technical, defence, legal and other activities in areas of national importance. The

absence of a conceptual framework for state policy in the field of artificial intelligence does not allow the creation and development of a competitive environment in these areas of activity [16].

The Ministry of Digital Transformation of Ukraine is working to overcome these problems, where it presented the Roadmap for the Regulation of Artificial Intelligence in Ukraine [17].

Its main idea is to create a transitional phase for 2-3 years, which will allow businesses to prepare for the transition to European legislation in this area and the implementation of the AI Act [18].

According to the authors, this approach to AI regulation by state authorities is optimal, since European legislation is one of the best in the world, and the leading institutions in this field were involved in the development of the document (AI Act). In addition, the fastest possible orientation towards these laws may facilitate Ukraine's accession to the European Union.

Conclusions. The research and analysis of numerous scientific papers and statistical publications resulted in a summary of more than 10 years of artificial intelligence development in the business sector.

In general, it was determined that artificial intelligence is constantly evolving, a conclusion that is supported not only by subjective impressions but also by significant investments in the field. Among the leaders contributing significantly to the overall development of this technology are giants such as Microsoft-owned OpenAI and their main competitor Google.

However, the business environment is seeing a greater diversification of companies and startups specialising in solving more specific problems. This requires businesses to put more effort into analysing the market for AI-based tools, but may prove to be more beneficial for companies that are more open to innovation. To make it easier for businesses to identify specific applications of AI, certain areas of AI use in the business environment have been outlined and presented in a convenient diagram.

It should be emphasised that AI poses certain threats to both business and society, which underscores the need for effective state regulation of this industry.

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Volodymyr Hryshko, Doctor of Economic Sciences, Full Professor. **Ihor Zinchenko**, Master Student, National University "Yuri Kondratyuk Poltava Polytechnic". **Synergy of AI and business as a factor of management efficiency in the context of technology development.**

The article summarises the more than 10-year history of artificial intelligence in business. Based on the data on investments in the world's 100 largest AI startups, the authors identifies the dynamics of investment growth over the past decade. It is noted that innovation-related businesses are looking for ways to implement artificial intelligence to optimise processes and gain competitive advantages. A list of business processes and tasks that companies can already improve with the help of AI is compiled and graphically depicted. However, alongside the potential benefits, the article also identifies possible challenges, such as data privacy, ethical considerations and the impact on education. The article concludes with the need for effective state regulation and orientation towards the European Union's legislation in the field of AI to ensure sustainable development and minimise risks.

Key words: artificial intelligence, management, economic environment, benefits and threats, government regulation.

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Ця наукова стаття присвячена комплексному вивченню впливу штучного інтелекту (ШІ) на різні аспекти бізнес середовища. Узагальнена більш сучасна історія розвитку штучного інтелекту в сфері бізнесу, засвідчуючи його зростаючу роль у якості технологічної інновації. Особлива увага приділена динаміці змін та тенденціям інвестицій протягом останніх десяти років, що вказує на стійкий розвиток цієї галузі. Виділено концептуальні проблеми штучного інтелекту, а саме необхідність великої кількості якісних даних, на основі яких ШІ буде навчатися та потім працювати, однак навіть наявність цих даних не гарантує відсутності помилок у роботі ШІ, що провокує іншу проблему, а саме недовіру та упереджене ставлення до даної технології з боку людей. Сформовано основні переваги та виклики впровадження ШІ в бізнесові процеси, звертаючи увагу на загальні та специфічні, аспекти даного питання. Визначаючи велику користь, яку підприємства можуть одержати від використання штучного інтелекту, в даній статті було сформовано конкретний перелік бізнес процесів та задач, в яких компанії можуть використовувати штучний інтелект. До них належить: обслуговування клієнтів, персоналізована реклама, зменшення часу відгуку, покращення процесу прийняття рішень, генерації ідей, оптимізації внутрішніх комунікацій, планів, презентацій та звітів, підбору персоналу та пошуку талантів, цифрові персональні помічники, кібербезпека та управління шахрайством, операції у ланцюжку поставок, управління запасами, написання коду та копіювання веб-сайтів. Згодом в статті розглядаються потенційні загрози, пов'язані з використанням штучного інтелекту в бізнесі. Серед цих загроз особливу увагу приділяється аспектам впливу штучного інтелекту на сферу освіти та якості знань та доброчесності молодих спеціалістів. Також розглядаються питання конфіденційності та захисту даних, що є важливими аспектами в контексті використання штучного інтелекту у бізнесі. Стаття закінчується роздумами щодо ролі державного регулювання в сфері ШІ. Презентовано концепцію Дорожньої карти з регулювання штучного інтелекту в Україні, яка наголошує необхідність вчасної орієнтації на європейське законодавство для забезпечення стійкого розвитку галузі в країні.

Ключові слова: штучний інтелект, управління, економічне середовище, переваги та загрози, державне регулювання.