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The Phenomenon of Artificial Intelligence in the Global Economy

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"Know the invisible from the visible"
(Hryhorii Skovoroda)

ABSTRACT. The phenomenal capabilities of artificial intelligence in a global perspective and its dynamic integration into a wide range of modern human activities have attracted increased attention from researchers in various fields of science. As artificial intelligence is increasingly being used in business activities, significantly increasing their productivity and efficiency, economists are faced with the task of identifying methodological approaches to studying the economics of artificial intelligence as a component of the global economy. Artificial intelligence is the leading technological trend in digital transformation, significantly ahead of other manifestations of the information and digital era in terms of development dynamics, investment attraction and dissemination in society. Significant progress in the creation of new models, systems, and technologies of artificial intelligence is radically changing the ways in which humans interact with devices and the environment. The use of artificial intelligence to automate business processes in companies leads to significant competitive advantages in the global turbulent business. At the same time, artificial intelligence poses a number of new challenges related to cyber threats, fraud and hacking, which are again being overcome with the help of artificial intelligence technologies. Against the backdrop of growing demand for artificial intelligence systems in the economy, finance, management, business, science and education, a separate specific high-tech segment of the global market has now formed, whose product and service range are provided by the artificial intelligence industry. The article presents a methodological approach to identifying the artificial intelligence economy, which consists of a number of interrelated components, and proposes an empirical formula for the artificial intelligence economy. Based on a summary of scientific and technological discussions on artificial intelligence, the article systematically outlines the prospects for its development in the coming years, indicating a wide range of industries and areas of application. The article focuses on the intensification of global competition between key representatives of the

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artificial intelligence industry — developed countries and high-tech corporations. It is noted that the phenomenon of artificial intelligence can become an important factor in global competitiveness in the economic, technological and military spheres. The technological horizons for the development of artificial intelligence are outlined, taking into account possible limitations in chip production and the need to search for new breakthrough technologies in the future.
KEYWORDS: global economy, artificial intelligence, artificial intelligence economy, digital transformation, global technology trends, artificial intelligence industry, business process automation, corporate cybersecurity, chips.

Introduction

Artificial intelligence (AI) has, without exaggeration, become the frontier of global digital transformation in the last decade. Combining a number of scientific and applied fields, including computational (mathematical) linguistics, computer science, and neuroscience, AI is rapidly developing and focusing on the development of intelligent systems to perform a variety of tasks that typically require human intelligence. The ability of AI to process, operate and analyse large amounts of information and data much faster and with greater accuracy than humans can do is radically transforming a wide range of areas of human life: from education to healthcare, from economics, management and finance to space exploration and forecasting, from robotics to expert analytical systems.

The phenomenal capabilities of AI, already demonstrated today, and even more so the prospects for its development in the foreseeable future, are driving increased theoretical and methodological attention to this important component of the global digital ecosystem. It can be predicted that AI using machine learning (ML) will continue to "learn" and improve, surpassing all existing modern technologies in terms of productivity and efficiency in science, manufacturing, business and everyday life.

This highlights the need to continue developing the theoretical foundations of the multidisciplinary science of AI, which is currently in its infancy due to the relative "youth" of global scientific research in this field. As a result, a separate specialised branch of economic science is beginning to take shape — the economics of AI. The expansion of scientific research in the field of AI economics is entirely justified given the important role that this phenomenon is beginning to play in the global economy, global business and global management.

Thus, the purpose of this article is to study the phenomenon of AI in the global economy in the context of forming the theoretical and methodological foundations of AI economics as a separate branch of economic theory.

Scientific and methodological approaches to studying the phenomenon of artificial intelligence in the paradigm of global technology trends

Scientific discourse in the field of AI in its various manifestations has now reached significant volumes and continues to grow rapidly[3]. Since the emergence of the first AI algorithms in the 1960s[4] and ending with the latest technological achievements and scientific experiments in the field of creating various AI systems and robots, scientists have focused their attention on the following main, mostly scientific and methodological approaches to this phenomenon:

1) logical-algorithmic (programming, modelling, machine learning (ML), expert-analytical and intelligent systems, neural networks);

2) technological (robotics, various sensors and devices, cyber-physical systems);

3) managerial (planning, optimisation, coordination, adaptation, identification, control and forecasting systems, analysis);

4) philosophical and ethical (the relationship between humans and knowledge, epistemology, the thought process, consciousness).

Most fundamental and applied AI research today focuses on these approaches, with most areas of research overlapping. This is primarily due to the nature of the phenomenon and the ongoing multidisciplinary discourse surrounding AI as a whole. Within this discourse, the most notable scientific works on global AI issues by contemporary scientists such as J. Searle, R. Penrose, M. Tegmark, S. Hawking, and R. Kurzweil deserve attention, and in particular as they consider AI in close connection with a number of other sciences, in particular philosophy, mathematics, physics, quantum cosmology, and futurology.

Leaving aside the significant scientific and technological context of the development of the AI phenomenon, we note that a significant increase in interest in began to be observed in the early 2000s against the backdrop of the unfolding of various processes of digital transformation, which covered most areas of modern human life: the economy, business, management, the social sphere, the information space, science, education, etc.[5]. These processes were

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[3] The article "Artificial Intelligence" in the Ukrainian version of Wikipedia currently contains more than 85 scientific, popular science, journalistic and literary sources, as well as other information materials and links related to AI. In addition, this article contains more than 25 related articles on AI, increasing the total volume of AI bibliography to more than 1,000 sources (!) according to rather modest estimates (*see* https://uk.wikipedia.org/wiki/Штучний_інтелект). (*authors' note)*

[4] One of the first researchers and inventors of AI systems was Mykola Amosov, academician of the National Academy of Sciences of Ukraine and world-renowned physician *(see* Amosov, N. M. (1969). Modeling of Thinking and the Mind. New York, Springer (English). doi:10.1007/978-1-349-00640-3). (*authors' note*)

[5] *Digital Economy: The Impact of Information and Communication Technologies on Human Capital and the Formation of Future Competencies: Monograph.* L. L. Antoniuk, D. O. Ilnytskyi, L. O. Lihonenko, O. O. Denysova et al. ; edited by Antoniuk L., Ilnytskyi D., Sevastiuk A. Kyiv: KNEU, 2021. 337 p.

accompanied by a rapid increase in investment (mostly venture capital, and later government investment) in various digital transformation projects and an expansion of the R&D palette in these industries, including the field of AI.

Since 2019, McKinsey has been conducting research on 15 contemporary technology trends in five categories: 1) the artificial intelligence revolution, 2) building a digital future, 3) computing and connectivity, 4) advanced development, and 5) a greener world (Table 1). To analyse the status of each trend, innovations (based on patents and R&D) and public interest (based on news and web search data) were evaluated. In addition, investment in relevant technologies and the level of their implementation by organisations were assessed.

Table 1

CHANGE IN ECONOMIC PARAMETERS OF TECHNOLOGICAL TRENDS, 2022–2023

Tech trend	Investment volume, $ billion		Job vacancies (as % of previous year)	
	2022	2023	2022	2023
I. AI Revolution				
1. Applied AI (automation, machine learning, ML)	104	86	+6	-29
2. Generative AI (ChatGPT)	5	36	+44	+111
3. Industrialisation of ML	3	3	+23	-36
II. Digital future				
4. Web 3.0 (based on blockchain)	62	n/a	+40	n/a
5. Trusted digital identification and cybersecurity	47	34	+16	-34
6. New generation software	2	17	+29	-37
III. Computing power				
7. Wireless technologies (5G/6G, high-speed WiFi, satellites)	118	29	+7	-24
8. Cloud technologies	84	54	+12	-38
9. Virtual reality technologies	16	6	+10	-36
10. Quantum technologies	2	1	n/a	-17
IV. Advanced engineering				
11. Mobility technologies and robotics	194	89	+15	-6
12. Bioengineering (including health)	43	62	-19	-23
13. Space technology (Starlink, launch vehicles, space debris, etc.)	8	9	+16	-9
V. Sustainable world				
14. Renewable energy (decarbonisation)	288	183	+27	+1
15. Climate technologies	86	68	+8	-11

Source: compiled based on data[6]

[6] McKinsey *Technology Trends Outlook 2024. The 15 tech trends.* 15 July 2024. Report. https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/the-top-trends-in-tech (accessed: 03.01.2024).

The data shows that the most dynamic growth in 2022-2023 was in the group of digital technologies related to AI, both in terms of investment volumes and the demand for relevant specialists in the labour market.

AI as a scientific, technological and social phenomenon is gaining immense popularity, demonstrating, without exaggeration, "exponential" dynamics of development and dissemination compared to other attributes of the information and digital age. For example, Netflix, launched in 1999, reached 1 million users in 3.5 years of operation, Twitter (in 2006) in 2 years, Facebook (in 2004) in 10 months, Instagram (in 2010) in 2.5 months, while Chat GPT (in 2022) reached 1 million users in just 5 days, and DeepSeek attracted 20 million users in just 20 days[7];[8].

Undoubtedly, such "exponentiality" is becoming characteristic of other information and digital spheres as well. For example, just 40 years ago, almost no one in the world knew how to use mobile phones, but by 2022, the number of mobile (cell) phone subscribers reached 8.6 billion, with a global population of 7.95 billion[9], [10]. Therefore, the answer to the question of how long it will take humanity to fully master AI lies at the intersection of current global technological, social and, possibly, demographic and mental trends, and seems more than obvious[11].

Implementation of artificial intelligence in global business processes

As part of the formation of a technologically integrated world, where digital technologies and automation are fully integrated into people's everyday lives, AI algorithms will adapt their learning, work, business, creativity, shopping and social interaction in ways that we are only beginning to imagine today. The latest research in the field of demography and generational analysis [12], conducted by Australian social analyst, demographer and futurologist M. McCrindle [13], predicts the arrival of

[7] Dombrovskyi V. The impact of artificial intelligence (AI) on the organisation of the educational process. *Materials from the joint meeting of KRASP and the Union of Rectors of Polish and Ukrainian Universities in the form of the 29th FRP School as part of the implementation of the Polish-Ukrainian MNiSW-PW project,* Pabianice, 7-10 July 2024.

[8] Skarbik P. DeepSeek reaches 20 million active users. *iTechua.* 09.02.2025. https://itechua.com/news/276496. (accessed 20.02.2025).

[9] World Economic Forum *Charted: There are more mobile phones than people in the world.* 11 April 2023. https://www.weforum.org/stories/2023/04/charted-there-are-more-phones-than-people-in-the-world/ (accessed 08.12.2024).

[10] The number of subscribers equalled the world's population in 2016 (*author's note).*

[11] In fact, the first call in history on a real mobile phone was made 52 years ago by one of Motorola's engineers on 3 April 1973 in New York (*author's note).*

[12] Introducing Gen Beta with Mark McCrindle. *The Future Report.* https://www.mccrindle.com.au/article/generation.beta-defined/ (accessed 25 January 2025).

[13] Mark McCrindle's research interests include tracking global social trends, exploring issues of global citizenship, and analysing generational cycles. In addition, he is the author of five books and coined the term for the latest generation — "Generation Alpha" (those born between 2010 and 2024). Incidentally, according to McCrendly, the next generation is Generation Beta (2025-2039), which, according to experts, will make up 16% of the world's population by 2035 and for whom their own digital identity will be a priority (*author's note).*

future generations for whom the digital and physical worlds will become "seamless", with an almost imperceptible difference between them.

A number of international information and analytical Internet portals[14] regularly evaluate the latest developments and achievements in the field of AI and machine learning (ML). Such studies provide a broad range of scientists and specialists with an idea of the expected changes, shaping global trends in the development of the industry[15]. In particular, an analysis of the capabilities of the latest OpenAI AI model, known as o3, points to an impressive result — an 85 per cent score on tests that assess "general intelligence". This figure significantly exceeds previous achievements (55 per cent), which corresponds to the average level of human intelligence. As noted, this success demonstrates significant progress towards the creation of artificial general intelligence (AGI), which will be capable of solving new problems based on a minimal number of examples (a skill considered critical for true intelligence).

Improving the adaptability of the OpenAI o3 model in different conditions and its actual approximation to AGI could, without exaggeration, revolutionise the industry, ushering in an era of self-learning AI with powerful global economic and technological impact and significant practical implications for everyday life.

According to MakeUseOf[16], 2025 will be defined by four key global trends related to the deep integration of AI into many areas of life, the economy, business, and education, radically changing the way humans interact with devices and the environment:

1) the expansion of the capabilities of AI assistants, which will become more like companions with unlimited options: from content recommendations based on activity history to the automation of routine processes depending on an individual's activities; however, the real breakthrough will come when voice and visual AI are combined, opening up opportunities for full contactless interaction;

2) AI-based search, which will make it possible not only to rely on keywords, as is the case with traditional search engines, but also to recognise the content of the query and take context into account, providing more accurate and relevant results; at the same time, AI will make the search more personalised, taking into account the user's preferences and

[14] For example, Tech Xplore (analyses and presents the latest achievements and innovative breakthroughs in engineering, electronics, hi-tech, technology and related businesses to the scientific and technological community) or MakeUseOf (one of the largest international expert online publications on technology, which millions of readers turn to for expert technical guidance) (*author's note).*

[15] "An AI system has reached human level on a test for 'general intelligence' — here's what that means." *Techxplore.com.* 24 December 2024. https://techxplore.com/news/2024-12-ai-human-general-intelligence.html (accessed 12 January 2025).

[16] "These Are the 4 AI Trends I'm Most Hyped for in 2025." *MakeUseOf.* 2 January 2025. https://www.makeuseof.com/ai-trends-2025/ (accessed 16 January 2025).

intentions, as well as adjusting the results, which will be more like a dialogue with a knowledgeable friend than an interaction with a machine;

3) a dramatic increase in office productivity: AI will help optimise work processes and streamline routine and labour-intensive tasks (e.g., data entry, report generation, email management, schedule management, setting reminders, prioritising work). This will free up employees' time to perform more strategically important and creative tasks. Features such as automatic translation, intelligent planning and meeting scheduling, and collaborative contextual work will significantly improve team interaction in project management.

4) approaching AGI and agentic AI:

a) although full AGI is unlikely to be achieved in 2025, this aspiration will drive significant breakthroughs in ML, neural networks, and cognitive computing; early versions of AGI already demonstrate a wide range of capabilities, from understanding language and logical reasoning to solving any intellectual tasks, universal problems, and displaying human-like creativity;

b) Agent AI will be able to make decisions autonomously and act on behalf of humans. Unlike modern AI systems, which mostly respond to commands, agent AI will be able to independently navigate complex environments, interact with other AI systems, and adapt to change.

Thus, breakthrough AI technologies are already radically changing the world today. AI is not only becoming ubiquitous in human life, but is also adapting to our desires and preferences, making decisions for us.

AI offers virtually limitless opportunities for automating business processes and improving efficiency in corporations, leading to significant competitive advantages such as the automation of a large number of repetitive and routine operations, the optimisation of resources and management systems, and the formation of strategies and future development scenarios in a multifactorial turbulent business environment.

Along with these obvious advantages that corporations currently owe to AI, businesses are facing new, difficult-to-overcome threats and risks that, paradoxically, are also caused by AI. In other words, AI helps corporations solve problems related to the efficiency of their own businesses and security, while at the same time provoking new threats[17].

This "dualism" of AI manifests itself, on the one hand, in the following opportunities for business:

a) automation of production and management processes, which reduces the need for resources, including human resources;

b) modelling and testing future risks, which helps to predict possible negative scenarios and prepare an appropriate action plan;

[17] Shevtsov, I. AI Risk: How Artificial Intelligence Is Shaping New Horizons in Corporate Security. 15 October 2024. *Liga.net.* https://blog.liga.net/user/ishevtsov/article/54473 (accessed 6 January 2025).

c) protection of commercial information (AI systems are used to manage the company's data protection process, which minimises human error and the risk of leaks; in addition, AI-based facial recognition and biometric systems improve the identification of individuals who have access to facilities and information);

d) behaviour analysis and fraud prevention, which is particularly relevant in the financial and banking sectors (detection of suspicious transactions, behavioural patterns, fraudulent schemes);

On the other hand, it manifests itself in threats such as:

a) unreliability and vulnerability of algorithms, which can damage a business and its reputation;

b) bias in recommendations, as they are often based on historical data or irrelevant analysis and interpretation;

c) regulatory compliance (the use of AI by companies to process personal data may lead to violations of user privacy laws);

d) corporate cybersecurity of AI systems themselves (they are becoming a new target for cyberattacks that exploit weaknesses in algorithms, data manipulation, and attacks on critical business processes).

Artificial intelligence and global corporate cybersecurity

AI tools are increasingly being used by cybercriminals to achieve their goals: from automating phishing attacks to manipulation and deception; from targeted attacks on companies and their employees on social networks and other resources to the creation of "malicious" code that complicates the work of antivirus systems; from theft of trade secrets to hacking AI systems for corporate business decision-making. And this list of hacker methods of influencing global business is far from exhaustive.

With the development of AI technologies, the development of various AI platforms and their implementation in all productive spheres of human activity, these technologies are almost instantly adopted by cybercriminals, creating serious problems for global business, global security and the global economy as a whole. Given the current trends of platformisation[18] and the networkisation of the global economy[19], this significantly complicates the functioning of global supply chains and creates additional risks for them, alongside geopolitical and geo-economic risks. The obvious and logical

[18] N. Srnicek. *Platform Capitalism.* Wiley, 2016.

[19] Nick Srnicek considers a platform to be a basic digital infrastructure that allows two or more groups to interact, positioning itself as an intermediary that connects various users — buyers and sellers of goods, services, information, data, etc. One of the important characteristics of a digital platform is that it generates a "network effect" and a "scaling effect." Based on this, it is possible to establish the primary and secondary nature of these two concepts (*author's note).*

response of governments and corporations to such challenges is a significant increase in spending on the implementation and improvement of cyber security systems, including the use of AI technologies, which undoubtedly affects the dynamics of global economic development.

The proliferation of hacking incidents targeting national and corporate computer systems, including energy[20] and telecommunications[21] systems, numerous blackouts as a result, the global spread of computer viruses[22], and interference in electronic voting systems are causing great damage to global economic stability. All this is made possible by a new type of weapon: *hacking.* According to B. Buchanan's definition[23], cyberspace has become a field for violent conflicts alongside military ones and, worst of all, in combination with traditional conventional military means. In addition, hacking acts as a tool of global competition between states and corporations[24].

The growing use of AI in combination with other innovative technologies in unmanned military systems requires special attention and thorough scientific research, as it makes modern warfare much more asymmetrical, primarily from an economic point of view: a relatively inexpensive drone with AI can effectively attack and disable an expensive battle tank or even an aircraft[25].

Methodological format of the artificial intelligence economy as a segment of the global economy

Against the backdrop of the growing integration of AI technologies into business processes, finance, banking, social, public, information, scientific and educational spheres, AI is beginning to occupy a significant product niche in the global market, forming a separate specific segment of this market at the intersection of goods and services. In 2024, there was a surge of interest in AI mobile applications, which led to rapid growth (more than 200 per cent compared to the previous year) in consumer spending on such applications.

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[20] For example, the hacking of the Ukrainian power grid in 2015 and 2016 (*author's note).*

[21] For example, the world's largest hacker attack on the telecommunications operator Kyivstar in Ukraine in 2023, as a result of which 24 million subscribers lost mobile and internet connectivity, while users were unable to connect to other operators' networks within Ukraine (*author's note).*

[22] For example, the NotPetya virus (*author's note).*

[23] Ben Buchanan — professor at the School of Foreign Service at Georgetown University, specialising in cybersecurity, artificial intelligence and public administration; works in the US government (*author's note).*

[24] Buchanan, B. *Hackers and States: Cyberwarfare as the New Reality of Modern Geopolitics.* Translated from English by Yu. Kazdobin. Kyiv: Nash Format, 2024. 352 p.

[25] Borrell, J. Combat operations in Ukraine have demonstrated the decisive importance of drones and artificial intelligence in modern warfare. *Ukrinform.* 13 October 2024. URL: https://www.ukrinform.ua/rubric-world/3915836 (accessed 21 December 2024).

According to the annual State of Mobile report by Sensor Tower[26], AI applications already constitute a billion-dollar industry. At the same time, in 2024, revenue from IAP (in-app purchases) for AI apps such as ChatGPT, Gemini, Duobao from Bytedance and others approached $1.3 billion[27]. The US is the clear leader in the Generative AI app market in 2024, accounting for 45 per cent of global revenue. The UK ranks second with approximately 4% of total revenue, followed by Germany (4 per cent), Japan (3 per cent) and Canada (3 per cent). And although the market for AI applications is currently significantly inferior to, for example, mobile games (global spending on games in 2024 has grown to $81 billion compared to last year), the growth rates (+200 per cent and +4 per cent respectively) look incomparable in favour of AI[28].

The use of AI technology is now becoming more widespread than chatbots and applications for creating works of art[29]. In the last two years alone, at least 100 apps in fifteen different categories of the digital app industry have used AI-related terms in their titles or descriptions, indicating that apps in various industries are actively implementing new AI features. This includes popular categories such as productivity, photo and video, education, as well as other categories in the mobile space such as lifestyle, finance, music and shopping[30].

In the two years since ChatGPT was launched, AI has gone from limited niche applications to mass adoption, fundamentally transforming the way we work with algorithms and diverse information. The coming years will further drive innovation in AI, which will continue to actively develop and expand its influence on the global economy, from reformatting entire industries, manufacturing, management, creative, scientific, educational and business processes to rethinking the user experience.

Summarising numerous discussions on specialised internet portals, forums of AI industry leaders and reports from international information technology agencies, we can identify nine key trends and make predictions about the integration of AI into the global economy in the coming years (Table 2).

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[26] Sensor Tower — a leading source of information on mobile apps, digital advertising, retail media and audiences for the world's largest brands and app publishers, founded in 2013; https://sensortower.com/. Today, this digital market analysis platform has expanded to include Audience, Retail Media and Pathmatics Digital Advertising Insights, helping brands and advertisers understand their competitors' advertising strategies and audiences on social media and mobile devices (*author's note).*

[27] Briskman J. 2025: State of Mobile: Consumers' $150 Billion Spent on Mobile Highlights Another Record-Setting Year. *Sensor Tower.* January 2025. https://sensortower.com/blog/2025-state-of-mobile-consumers-usd150-billion-spent-on-mobile-highlights/ (accessed 05.02.2025).

[28] Ibid.

[29] In 2024, users spent nearly 7.7 billion hours on AI apps, and apps mentioning "AI" were downloaded 17 billion times. ChatGPT alone had 50 million monthly users, more than Temu, Disney+ or YouTube Music (*author's note).*

[30] According to Sensor Tower, e-commerce apps ranked first in terms of downloads in 2024 thanks to their spread in Europe, Asia and Latin America, while crypto apps (such as Binance and Tonkeeper) were among the top ten financial apps (*author's note).*

Table 2

PROSPECTS FOR THE DEVELOPMENT OF AI IN THE GLOBAL ECONOMY

AI technology	Main goal	Scope of application	Modern prototype
Agent AI	Transformation of the software industry	- management of multi-stage work processes; - supply chain management; - customer interaction	Gemini AI Agents (Google), Orchestrator bots Microsoft, OpenAI operator agents
Multimodal AI	creating a virtual assistant	- healthcare programmes; - content creation (multimedia presentations, media file editing)	Alexa
Open source AI	expanding the scope of application	- public sector; - local government bodies; - regional studios; - SMEs	Meta, OpenAI, DeepSeek
Generative AI	creativisation of creative, intellectual and scientific activities	- creative industries (advertising, design, literary, artistic and musical works, layout, modelling, prototyping); - discovery of new medicines and materials; - education; - workplace productivity (integration into daily work processes)	DALL-E, AlphaFold
Specialised AI models	meeting specific industry needs	- finance (transaction analysis, fraud detection); - healthcare (disease diagnosis, treatment outcome prediction); - robotics; - peripheral devices (drones, IoT sensors, vehicles, autopilots)	DALL-E, Adobe Firefly
Responsible AI	ensuring compliance with ethical standards	- privacy (GDPR); - bias and fairness (testing, oversight, auditing, global cooperation in AI)	Apple
AI for sustainable development	smart resource management, waste reduction, aligning technological innovation with environmental priorities	- smart energy systems (optimisation of power grids, consumption balancing, integration of renewable energy sources); - agriculture (drones with AI for crop monitoring, irrigation and pest detection); - green technologies; - circular economy (recycling systems);	Siemens, AMP Robotics

AI technology	Main goal	Scope of application	Modern prototype
		- climate modelling and forecasting; - supply chain optimisation (logistics networks, routes, fuel, delivery)	
AI for cybersecurity	revolution in cybersecurity	- protection mechanisms (real-time analysis of large amounts of data, anomaly detection) - automatic response to incidents; - neutralisation of AI-driven threats; - AI-based arms race	CrowdStrike, Darktrace
Client AI	creating personalised user interaction	- memory and context awareness; - multimedia interaction; - emotion recognition; - real-time adaptation	Alexa, Siri, Google Assistant

Source: compiled based on data[31] from TechStartups[32].

Technological progress in the field of AI and its rise to a leading position in the global economy affects not only software and algorithms, but is based primarily on state-of-the-art hardware and sophisticated manufacturing infrastructure. Without these components of the global AI industry, it is impossible to lay the foundation for effective and productive AI systems. In the next few years, the race to develop state-of-the-art hardware for AI will accelerate and cover the following segments[33]:

1) Next-generation processors, integrated circuits, and chips (companies such as NVIDIA, AMD, and Intel are expected to continue developing and releasing specialised chips designed for large models, edge computing, and real-time applications).

2) Innovations in AI hardware (the emergence of AI accelerators such as Google's Tensor Processing Units (TPUs) and Apple's Neural Engine will fundamentally change the hardware landscape; these chips are optimised for ML tasks, making AI faster and more accessible);

3) Energy efficiency and sustainability (as AI systems become larger and more resource-intensive, energy consumption is becoming, without

[31] Louise N. Top 15 AI Trends for 2025: Expert Predictions You Need to Know. 1 January 2025. https://techstartups.com/2025/01/01/. (accessed 15 February 2025).

[32] TechStartups.com is a technology news and information website covering the latest trends, news and innovations in the startup and technology industry. The site features articles, interviews and insights from technical experts and entrepreneurs, as well as updates on funding and investment opportunities in technology startups. It covers the latest innovative technologies and analysis of AI, cryptocurrencies, blockchain-supported crypto assets such as Bitcoin, Ethereum, Steem, cloud computing, cybersecurity, microservices, big data and other digital technologies (*author's note).*

[33] Louise N. Top 15 AI Trends for 2025: Expert Predictions You Need to Know. 1 January 2025. https://techstartups.com/2025/01/01/. (accessed 15 February 2025).

exaggeration, a critical factor, driving the priority of energy-efficient hardware, including advanced cooling systems);

4) Self-learning systems (through self-learning using *meta-learning* algorithms, AI will be able to autonomously improve its performance by analysing its own mistakes and optimising processes, thereby reducing the need for human intervention in fine-tuning AI);

5) AI on devices (a sharp increase in the number of AI chips designed for smartphones, IoT devices, and autonomous vehicles is expected in the near future);

6) Data infrastructure (data storage and transmission systems, high-speed interconnections, distributed solutions, and scalable cloud infrastructure are vital for large-scale AI deployment; Companies such as AWS, Google Cloud, and Microsoft Azure are investing heavily in the development of optimised data centres, while innovations such as NVMe over Fabrics (NVMe-oF) are improving data access speeds for AI applications.

7) Quantum computing in AI (discovery of new methods for using quantum systems to accelerate AI model training and improve optimisation algorithms).

Today, global competition for leadership in AI innovation is intensifying between the major technological players: the US, China and the EU. At the same time, each of them is choosing its own technological niche. Thanks to significant private and public investment, the US is utilising such technological giants as OpenAI, Google, Microsoft and NVIDIA, which primarily contributes to the development of generative AI and AI infrastructure.

China, with the support of public funding and corporations such as Baidu, Alibaba, and Tencent, is scaling up the use of AI in industrial automation, healthcare, and surveillance systems as part of the Made in China 2025 initiative. At the same time, the EU is prioritising ethical leadership in AI through the implementation of specific EU legislation that sets global standards for transparency and fairness[34].

Other technologically advanced countries, including South Korea, Japan and India, are promoting their AI technologies in robotics, agriculture and healthcare. This competition concerns both technological and innovative dominance and the formation of global AI policy. The US, China and the EU are expected to continue to lead the way in this competition. Each will leverage its competitive advantages: the US has its tech giants, China supports large-scale AI projects, and the EU focuses on shaping global AI standards.

[34] Otsokolic V. European law on artificial intelligence comes into force. On the basic requirements and obligations when using artificial intelligence. *Ligazakon.* 8 August 2024. URL: https://biz.ligazakon.net/analitycs/229699/ (accessed 01.12.2024).

It is evident that this "race" not only determines global technological trends and the speed of transformation of global production today, but also influences the configuration of the future architecture of global economic policy. The high level of tension in this competition is demonstrated by the dynamics of the emergence of free AI models for users on the market. For example, OpenAI launched its new o3-mini reasoning model in ChatGPT and API services just a few days after Microsoft did so with its o1 model and DeepSeek[35].

As mentioned above, the various AI applications, models, and systems that exist today have formed a separate, significant, and rapidly growing segment of the global market. However, the global AI industry includes several other interrelated components, the most important of which are 1) the production of chips (various semiconductors, microcircuits, etc.), 2) equipment for their production, and 3) the production of machines, devices, mechanisms and various peripherals using AI systems. Auxiliary, but no less important components of this industry, the results of which form the corresponding segments of the global AI market, are 1) new materials for the production of chips and equipment, 2) scientific research, and 3) innovations in the field of AI.

It is clear that these components form high-tech and knowledge-intensive value chains, the maintenance of which requires reliable infrastructure support.

Therefore, using a methodological approach and taking into account the above, we can present an empirical formula for *the AI economy* as a segment of the global economy in the following form:

$$E_{ai} = \{E_{sw,a}, E_{c,m,s}, E_{eq}, E_m, E_d, E_i\}, \quad (1)$$

where $E_{sw,a}$ — the industry of software, algorithms, models, applications and systems of AI or based on AI;

$E_{c,m,s}$ — the industry of chips and various semiconductors for devices using AI;

E_{eq} — the industry of equipment, machinery and mechanisms for the production of chips and various semiconductors for AI;

E_m — the industry for the production of materials for the AI sector;

E_d — the industry for the production of various devices, apparatus and equipment using AI;

E_i — innovation and R&D in the field of AI.

According to the Indian consulting technology company Fortune Business Insights, the global semiconductor market was valued at

[35] OpenAI has released ChatGPT o3-mini to compete with DeepSeek. 3 February 2025. *ITsider*. URL: https://itsider.com.ua/openai-vypustyla-chatgpt-o3-mini-dlya-konkurentsiyi-z-deepseek/ (accessed 08.02.2025).

$611.35 billion in 2023 and is forecast to grow from $681.05 billion in 2024 to $2,062.59 billion by 2032, demonstrating a CAGR of 14.9 per cent during the forecast period (2024-2032). In 2023, the Asia-Pacific semiconductor industry accounted for 50.53% of the global semiconductor market[36].

Fortune Business Insights has included the following companies in its list of the world's leading semiconductor manufacturers: Broadcom, Inc. (United States), Samsung Electronics (Republic of Korea), Intel Corporation (United States), Maxim Integrated Products, Inc. (United States), Taiwan Semiconductors (Taiwan), Micron Technology (United States), NXP Semiconductors N.V. (Netherlands), NVIDIA Corporation (USA), Qualcomm (USA), SK Hynix (Republic of Korea), Texas Instruments (USA), and Toshiba Corporation (Japan).

The global semiconductor manufacturing equipment market was valued at $110.91 billion in 2023 and is projected to grow from $121.17 billion in 2024 to $270.38 billion in 2032, exhibiting a CAGR of 10.6 per cent during the forecast period. The Asia-Pacific region dominated the semiconductor manufacturing equipment market with a 67.89 per cent share in 2023[37].

The list of the world's leading companies and largest manufacturers of semiconductor equipment includes: Applied Materials Inc. (USA), Tokyo Electron Limited (Japan), Lam Research Corporation (USA), ASML (Netherlands), Dainippon Screen Group (Japan), KLA Corporation (Netherlands), Ferrotec Holdings Corporation (Japan), Hitachi High-Technologies Corporation (Japan), ASM International (USA), and Canon Machinery Inc (Japan).

The data presented clearly demonstrates the concentration of high-tech companies and manufacturing facilities for the global AI industry. It is expected that this concentration — in the USA, Asia-Pacific countries and the EU — will continue in the future, as will the high level of global competition in this field.

According to K. Miller[38], microchips are "the oil of the 21st century." The whole world is becoming dependent on this "scarce resource," because almost everything today runs on chips and microcircuits: from modern household appliances, computers and smartphones to rockets, drones, transport and the financial market. A fierce war for dominance is being waged between states and global corporations, which is no less intense than

[36] *Semiconductor Industry Outlook Analysis 2024-2032.* 13 January 2025. https://www.fortunebusinessinsights.com/semiconductor-market-102365, https://www.fortunebusinessinsights.com/semiconductor-manufacturing-equipment-market-101964. (accessed 20 January 2025).

[37] Ibid.

[38] K. Miller is an economic historian, scholar, professor of world history at Tufts University's Fletcher School, director of Eurasia at the Foreign Policy Research Institute (USA) and a consulting company Greenmantle, which specialises in geopolitics and macroeconomics (*author's note).*

modern conventional wars [39]. Science, innovation, technology, natural resources, manufacturing, markets, the economy, finance, investment and politics are all being drawn into the maelstrom of this war.

However, according to experts, the horizons of this struggle currently appear more than vague. This is explained not so much by economic factors as by purely technological and even physical factors. Global demand for computing power is expected to grow steadily, while supply may decline. At some point, the laws of physics may make it impossible to further reduce the size of transistors (chips), and their production may become economically unviable [40]. The rate of decline in chip costs will slow significantly or stop altogether, and the manufacturing equipment needed to produce them will become too expensive (even now, an EUV lithography machine costs over $100 million) [41]. Further technological development in this area may also slow down. For example, it took the microelectronics industry a decade to reach a technological barrier such as reducing the size of a transistor to a quarter of a micron.

In this case, for further progress in this area, humanity will need to seek out new revolutionary breakthrough technologies (perhaps based on space or quantum technologies) and new materials with properties that are currently unattainable on Earth (perhaps of an extraterrestrial nature). The transition to the next technological paradigm, the use of micro-, nano- and quantum technologies, will be driven not least by the need for a significant increase in computing power, which is critical for the further development of AI in the global economy.

Conclusions

The digital transformation of the global economy is currently determined by the dynamic integration of breakthrough technological achievements into all spheres of human activity: business, social, environmental, demographic, and informational[42]. AI technologies occupy a special place in the list of digital technologies. They have begun to develop actively over

[39] Miller, K. *Chip War: The Battle for the World's Most Important Technology.* Translated from English by Volodymyr Tsybka. — Kyiv: Nash Format, 2024. — 432 p.

[40] This follows from the so-called Moore's Laws, formulated as empirical conclusions by Gordon Moore, an American computer engineer, entrepreneur and billionaire, co-founder and long-time president of Intel Corporation. According to the first law (1965, after the invention of the first integrated circuit), the power of computing equipment will grow exponentially over time, according to the second law (1998), the cost of microchip manufacturing equipment grows exponentially with the complexity of microchips. Therefore, according to experts, Moore's laws will cease to apply when transistor sizes reach a barrier beyond which their manufacture will be economically unprofitable or technologically impossible (*author's note).*

[41] *Miller, K.* Chip War: The Battle for the World's Most Important Technology / translated from English by Volodymyr Tsybka. — Kyiv: Nash Format, 2024. — 432 p.

[42] Lukyanenko, D., Pavlovsky, D., and Sidorenko, O. 2023. "The Digital Imperative of Global Economic Development." *International Economic Policy* 2, no. 39: 7–26. https://doi.org/10.33111/iep.2023.39.01.

the last decade against the backdrop of information and digital innovations and growing interest in them on the part of governments and corporations as a factor of technological dominance and global competitiveness. The rapid increase in investment and expansion of the range of research and development in the field of AI has necessitated the formation of a separate multidisciplinary science of AI, an important component of which is the economics of AI. Given the importance of researching the problems of positioning and the impact of AI on globalisation and the global economy, as well as the interconnection between the economics of AI and other sciences, the relevance of such research is growing.

The latest developments in AI are, without exaggeration, revolutionising a wide range of industries, radically transforming the way humans interact with devices and the environment. AI offers virtually unlimited possibilities for business process automation, helping to solve problems of efficiency and optionality. At the same time, AI technologies can pose global risks to states and corporations when used by cybercriminals, requiring additional attention and significant investment to implement and improve cyber defence systems, including those based on AI.

The AI industry has now formed a significant and constantly growing segment of the global market, with a fairly broad range of goods and services consisting of various programmes, applications, systems, hardware, special equipment for the production of AI-based chips, devices and equipment, and infrastructure components to support the functioning of this industry. This, in turn, forms a separate economic science — the economics of AI as a component of the global economy.

Global competition for leadership in AI innovation between global technology players — developed countries and high-tech corporations — is intensifying. The US, China, the EU and a number of other technologically advanced countries are currently not only determining global technological trends and the speed of transformation of global production using AI, but also influencing the future architecture of global economic policy. This competition encompasses not only technology and innovation, but also directly concerns global economic dominance, global security and global politics.

* This article was translated from its original in Ukrainian.

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