Proceedings of ICEMGD 2024 Workshop: Policies to Enhance Sustainable Development through the Green Economy
DOI: 10.54254/2754-1169/123/2024MUR0143

The Impact of Artificial Intelligence on Economic Growth

—An Industrial Structure Based Perspective

Donghao Liu[1,a,*]

[1]*United International College, Beijing Normal University Hong Kong Baptist University, Zhuhai, 519000, China*
a. t330036087@mail.uic.edu.cn
**corresponding author*

Abstract: Artificial intelligence is the leading technology of the new round of scientific and technological revolution and industrial revolution, and its impact on the economic development is profoundly intricate and has garnered significant attention from scholars and professionals across various sectors. The industrial domain, serving as the backbone of economic progress, plays a crucial role in fostering high-quality economic growth. Industry, as the core carrier of economic development, is of great significance for high-quality economic development. AI technology penetrates into various industrial sectors through its techno-economic characteristics, and has an impact on the industrial structure and economic growth mode. Based on combing the current situation and future trends of AI development, this paper analyses in detail the role mechanism of AI affecting the transformation and development of the three major industries, and discusses the impact of AI on economic growth, with a view to providing useful reference for the research and practice of AI, industrial development and economic growth. Through a comprehensive review, this study seeks to provide valuable insights into how AI can be harnessed to propel industrial development and sustain economic growth.

Keywords: Artificial intelligence, economic growth, industrial structure.

1. Introduction

Artificial Intelligence, also known as Machine Intelligence, abbreviated as AI, usually implies the implementation of human intelligence through computer programmes. AI technology is a new technological science that can simulate any process about human consciousness and logical thinking, and can even think like a human being, and can also exceed human intelligence [1]. AI absorbs human's massive knowledge and objective world data through networks such as the Internet of Things and cloud computing platforms, continuously learns and evolves in depth, derives and applies robots, language recognition, image recognition, natural language processing and specialised systems, and so on, to become a universal integrated technology and fusion innovation tool. Under the wave of the new round of scientific and technological revolution, the new scientific and technological convergence and innovation with artificial intelligence, big data and cloud computing, Internet of Things, 3D printing, intelligent robots (hereinafter referred to as the new scientific and technological revolution pioneering technologies) as the spearheads are constantly optimising the tools, modes,

DOI: 10.54254/2754-1169/123/2024MUR0143

speeds and processes of innovation, profoundly altering the production and life of human beings and the paradigm of innovation, and exerting unprecedented and tremendous influence on the economy, industry and society.

AI is the core driving force of the new round of industrial change in the 21st century, and the development of AI and its industries will certainly create a new powerful engine. Currently, AI is accelerating its integration with various industries, fuelling the transformation and upgrading of traditional industries and improving quality and efficiency, and having a profound influence on economic growth. Based on the support of national policies and the importance of AI and its industrial development, there is an urgent need to study the relationship between AI and economic growth in order for the AI industry to effectively play a driving role in economic growth and promote the high-quality development of the technology economy. On the other hand, many segments within the secondary and tertiary industries have applied AI technology to enhance their development. However, since the application of AI in many industries is still at an early stage, the impact of its application on economic growth and structural optimisation is not yet clear, a detailed analysis is needed to guide different industries to better cope with the impact of AI technology and further enhance the positive effects of AI on economic growth. The paper also discusses how different industries are responding to the challenges posed by AI and offers suggestions for fostering the development of the AI industry to drive high-quality economic growth. Finally, the article summarizes the overall impacts of AI technologies on industrial development and economic growth and highlights future research directions. The paper also concluded that AI has promoting roles in Agriculture, Manufacturing, and Service Industries. Some strategies and suggestion in this article could give better guidance for production activities.

2. Basic Situation of AI

2.1. Current Situation of AI Development

Accurately understand and grasp the current status of AI technology and industry development is first necessary to study the relationship between AI and economic development. The following summarises the main development status and characteristics of current AI.

2.1.1. AI as a Whole is in a Rapid Growth Trend

The current global AI industry is in a period of rapid development. According to the data from Statista [2], the total global AI investment scale is $128.8 billion in 2022, and the total global AI investment scale is expected to reach $154 billion in 2023, a year-on-year increase of 19.6%. Looking ahead to 2024, the development of the AI industry will become the wind vane of global economic recovery. According to the Sullivan Consulting forecast, the global AI market is expected to reach US $615.8 billion in 2024. The number and amount of investment and financing in the field of AI will reach another record high, and the development trend will continue to be positive (see Figure 1).

DOI: 10.54254/2754-1169/123/2024MUR0143

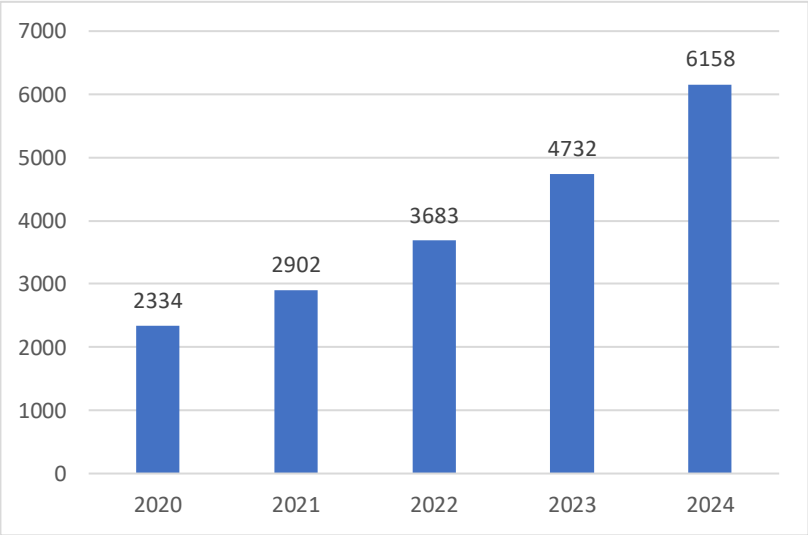

Figure 1: Global AI Market Size, 2020-2024 (USD Billion)

2.1.2. Important Breakthroughs in Specialised AI

From the perspective of applicability, AI could be broadly categorized into specialized AI and generalized AI. Specialized AI systems, designed for specific tasks like playing Go, have achieved significant advancements in their respective fields. This success can be attributed to factors such as focused tasks, well-defined requirements, clear application boundaries, abundant domain knowledge, and relatively straightforward modelling. As a result, specialized AI has been able to surpass human performance in certain narrow domains. Recent AI progress has primarily concentrated on specialized intelligence. For instance, AlphaGo defeated the world champion in Go, AI systems have outperformed humans in tasks like large-scale image and facial recognition, and AI models have achieved expertise comparable to professional doctors in diagnosing skin cancer. While specialized AI has seen considerable progress, the development of generalized AI still faces significant challenges, and overall, AI as a whole remains in an early stage of growth.

2.1.3. AI Innovation and Entrepreneurship

The global industry widely acknowledges the significant role of AI in spearheading a new wave of industrial transformation, and has consequently recalibrated its development strategies. For instance, at its annual developer conference in 2017, Google explicitly shifted its focus from a 'mobile-first' to an 'AI-first' approach. Similarly, Microsoft's fiscal year 2017 annual report marked the first instance where AI was positioned as the cornerstone of the company's strategic vision.AI is at the forefront of innovation and entrepreneurship. McKinsey & Company report pointed out that the global investment in AI research and development exceeded 30 billion U.S. dollars in 2016 and is in a phase of rapid growth; as of June 2023, the scale of China’s core AI industry has reached 500 billion yuan, and the number of AI enterprises is more than 4,400 companies.

2.1.4. The Social Impact of AI is Becoming More and More Prominent

On the one hand, as the driving force behind the latest scientific and technological revolution and industrial transformation, AI is facilitating the modernization of traditional industries, accelerating the swift development of the unmanned economy, and exerting a beneficial influence on various

DOI: 10.54254/2754-1169/123/2024MUR0143

aspects of daily life, including intelligent transportation, smart homes, and intelligent healthcare [3,4]. On the other hand, challenges such as the protection of personal information and privacy, as well as the intellectual property rights of AI-generated content. The issues of potential discrimination and bias in AI systems, traffic regulations for unmanned systems, and the technological ethics surrounding brain-computer interfaces and human-computer symbiosis have already surfaced, significantly needing solutions. For example, related literature has studied and analysed AI and economic growth. Hanson used a neoclassical economic growth model to estimate the impact of machine intelligence on the economy, and found that the use of machine intelligence increases the economic growth rate [5]. Aghion provided a comprehensive analysis of how the development of AI would strongly drive economic growth, pointing out that automation brought about by AI promotes economic. Brynjolfsson argues that modern technologies such as the internet and computers have played a key role in increasing productivity and driving economic growth, and that the impact of AI on this is likely to be even greater [6].

2.2. Future Trends of AI

At present, AI has been widely used in all aspects of people's daily life, and the introduction of AI tools has also brought a huge increment to the development of the digital economy, and its development trend is healthy, stable, sustainable and optimistic. At the same time, in the process of industrial intelligent transformation and upgrading, the participation of traditional industries will become more and more in-depth, which will provide massive data and richer application scenarios for AI, and open up new space for the application of AI. In the next few years, AI will continue to develop in the direction of greater intelligence, autonomy and popularisation. With the optimisation of algorithms and the improvement of arithmetic power, AI will be able to handle more complex problems and achieve more accurate decision-making and prediction. Meanwhile, with the development of 5G, IoT and other technologies, AI will be deeply integrated with these technologies to achieve a wider range of applications. In addition, with the support of policies and the influx of capital, the AI industry will continue to grow and become an important force in promoting economic and social development.

3. Contribution of AI to Economic Growth

3.1. The Promoting Role of AI on Agriculture Industry

The supportive role of AI in the process of agricultural production and management is reflected in the fact that, in order to achieve the development goals of precision agriculture, safe agriculture and ecological agriculture, through the application of the Internet of Things, big data, cloud computing and intelligent terminal equipment, it builds an intelligent agricultural system of perception, identification, analysis and decision-making, and pushes the transformation and upgrading of agriculture from traditional agriculture to intelligent agriculture. Firstly, precision agriculture is mainly an intelligent agriculture that uses AI to achieve the perception, control and input decision-making process. In the production process of precision agriculture, the investment in the Internet of Things, big data computing and intelligent terminals and equipment forms capital deepening, and at the same time brings innovation and upgrading of production technology to achieve the decision-making goal of precise discovery and control of agriculture. In this way, it can save the time of determining and dealing with crop growth problems, improve the efficiency of agricultural production, and consolidate the technical foundation for the improvement of production quality. Secondly, safe agriculture is mainly based on precision agriculture, crop safety and labour safety intelligent agriculture. Through the precision agriculture production program, production tools can be upgraded, both through labour substitution, reducing labour costs, improving production efficiency and

DOI: 10.54254/2754-1169/123/2024MUR0143

protecting labour safety; and through technological progress, adopting advanced production equipment, reducing crop disaster losses, lowering production costs, and improving production efficiency and product quality. Eventually, intelligent agriculture with crop safety and labour safety will be achieved. Thirdly, ecological agriculture is mainly based on precision agriculture and safe agriculture, and realises efficient land and environmental utilisation, resulting in smart agriculture in harmony with nature. Ecological agriculture programmes can reduce the maintenance and restoration time of arable land, which in the long term is conducive to the maintenance of the quality of land resources and improves the quality of arable land production and the efficiency of agricultural production operations. At the same time, through the analysis of land use data, land use can be effectively assessed and effective land use programmes can be provided. Therefore, AI technology can help traditional agriculture transform and upgrade to eco-agriculture and achieve the harmonious development of land, environment and nature. In short,via the joint efforts of the Internet of Things, big data and intelligent terminals, AI achieves the improvement of agricultural production efficiency, the reduction of production costs and the improvement of the quality of production at the first level through the upgrading of production technology, production tools and production management, and promotes the transformation and upgrading of agriculture from traditional agriculture to intelligent agriculture.

3.2. The Promoting Role of AI on Manufacturing Industry

The mechanism of the impact of AI on the manufacturing industry, that is, the impact of AI on the production and management within the production enterprise, mainly includes the operation integration system that connects the production enterprise's machines and equipment, business processes, and application systems (vertical integration), as well as the whole chain integration system within the production enterprise that includes the workflow of design, production, logistics, sales, and service across departments and workshops (horizontal integration). Firstly, production intelligence is mainly a transformation of the production mode, i.e., to achieve information-based, integrated and autonomous production through artificial intelligence analysis and decision-making. Taking the production target as the starting point, AI analyses and plans the allocation of production resources through machine learning, deep learning, etc., including the whole process of production operation such as the amount of raw materials, the amount of accessories, the logistics transmission of production factors, the use of equipment, the preparation and planning of work processes, the control of risk points of product testing and safety management, and so on. Intelligence in the whole production process will circumvent the problems of time lag in decision-making, accurate operation, idle equipment and low operational efficiency in the production process, and therefore will promote the continuous optimisation and reduction of energy consumption. Secondly, management intelligence is the process of networked manufacturing to converged manufacturing, i.e., information - manufacturing convergence mode (IoT), so that the digital and physical to establish a mapping relationship, to achieve the digital twin manufacturing function. Through the digital system to command the physical system production, the physical system production feedback to the digital system information as the next implementation of the experience input - artificial intelligence deep learning to achieve the creation of knowledge, to achieve the overall production efficiency, the production of trial and error to reduce the target. In short, 'AI + manufacturing' transformation and upgrading is through the intelligent equipment to support the production of intelligent, intelligent management functions to achieve, and then the implementation of accurate quality control and processing, labour force substitution, and energy, raw materials, production equipment and other factors of production and efficient allocation, in order to achieve product quality enhancement, production cost reduction and production efficiency. For China, the upgrade of 'AI + manufacturing' will increase China's GDP growth rate by 1.4% [7], and it is expected that by 2035, the growth rate

DOI: 10.54254/2754-1169/123/2024MUR0143

of manufacturing value-added can be ranked first among all industrial sectors, increasing by about 2% [8].

3.3. The Promoting Role of AI on Service Industry

The large number of industries within the service industry makes it difficult to identify uniform standards for measuring service quality. As a result, the inconsistency of the claims or development goals of the industry segments within the service industry has led to inconsistencies in the ways in which new-generation information technologies, such as AI, can empower the service industry. However, it is still possible to sort out a mechanism with relative commonality of the impact of AI on the service industry based on the current AI product and service system by examining the situation of the medical, education, financial and other service industries that have a generally high degree of integration with AI. The overall logic of AI-enabled service industry is 'technology + traditional service industry scene'. AI technology is integrated into AI products, and the technology-enabling capability is released through the application of AI products in various scenarios of the traditional service industry, so as to play a rapid response to meet the needs of customers for improving service quality and lowering service prices. Assuming that customers prefer cost-effective products and services, i.e., the price and service quality are in line with the customer's psychological expectations, the application of AI technology products will improve the overall user satisfaction and drive the increase in consumer demand. Therefore, AI can not only improve the quality level of the development of the service industry to improve user satisfaction as a criterion, but also increase the output value of the service industry, and promote the service industry into an efficient and high-quality development track.

4. Suggestions for Artificial intelligence in promoting economic growth

4.1. Agriculture Industry

Under the backdrop of artificial intelligence, agricultural management is advancing towards a new era characterized by big data intelligence, collective intelligence, cross-media intelligence, and 'hybrid-enhanced' intelligence. This evolution also encompasses the development of autonomous intelligent agriculture, leading to innovative models such as precision agriculture, facility-based agriculture, precision farming, and marketing agriculture [9]. There are three pathways for the advancement of smart agriculture: first, leveraging intelligent alternatives to reduce labor requirements; second, increasing capital investment to upgrade traditional production tools into smart technologies; and third, enhancing the application of intelligent technology to facilitate advancements in agricultural techniques and management practices—ultimately improving the quality of agricultural products [10]. It is evident that achieving high-quality development in smart agriculture necessitates harnessing AI technology to replace traditional production factors like labor and tools, thereby enhancing agricultural productivity. Concurrently, employing big data analytic, Internet of Things (IoT) applications, and AI technologies will elevate the standards of agricultural management. Through this dual enhancement approach—improving both efficiency and management—the quality of agricultural products will be elevated; total factor productivity within agriculture will increase; supply-side reforms will be advanced; and ultimately, agriculture will progress towards high-quality development.

4.2. Manufacturing Industry

In terms of development model, AI should be leveraged to transform the manufacturing industry across six dimensions: product intelligence, equipment intelligence, production intelligence,

DOI: 10.54254/2754-1169/123/2024MUR0143

management intelligence, business application intelligence, and industrial ecological intelligence. This approach aims to foster the healthy operation of intelligent production management, intelligent production operations, intelligent organizational management, intelligent business models, and intelligent enterprise competition models. It effectively promotes the deep integration of AI with the manufacturing industry [11]. From a technical operations perspective, it is imperative to harness the capabilities of a new generation of AI to construct a multifaceted, cross-media, heterogeneous database. Additionally, a big data-driven mining system designed to meet specific requirements, a virtual experience system, a virtual manufacturing system, and a fully automated information collection, production control, and collaborative optimization system are key technologies that need to be developed. Moreover, data mining technology, sensor technology, embedded monitoring systems, fault prediction algorithms, machine vision technology, machine learning, and other supporting technologies should be advanced to elevate the development of intelligent manufacturing to a higher level [12].

4.3. Service Industry

Since the characteristics of the application scenarios of 'AI+Service Industry' vary greatly, it is difficult to consider the development of the service industry from the perspective of a unified framework. For example, some studies have taken the lead in summarising the application of AI in the financial sector in advanced developed countries and put forward China's countermeasures. However, China's financial services intelligence still needs to continue to improve the rules of the financial transaction market, strengthen information security and cybersecurity, and enhance the role of AI in financial regulation if it is to realise its application. In addition, a study focuses on China's aging population and the unreasonable layout of regional pension services and other contradictory problems, by analysing the characteristics of China's aging and the requirements of high-quality development of the pension industry, it is believed that AI technology can improve the scale of the pension industry, the industrial system, the industrial layout, and the industrial ecology, and promote the high-quality development of the pension industry [13]. From the perspective of 'AI+service industry' products, it is found that intelligent service robots, unmanned vehicles, AIoT (intelligent Internet of Things), entertainment and assistants, and other public and private service AI products, as well as medical, financial, legal, education, logistics and other industry AI products are subtly changing the production and life of human beings, and are also silently affecting the service industry. silently transforming and upgrading the service industry [14]. From the perspective of the development path of the intelligent service industry, it is necessary to innovate the intelligent service industry model, meet the demand for consumption upgrading, consolidate the foundation of the intelligent service industry infrastructure and public service system, and improve the intelligent service industry system, regulatory laws and ethical restrictions and other related measures, so as to promote the high-quality development of the intelligent service industry [15].

5. Conclusion

This paper analyses the impact of artificial intelligence on economic growth by analysing the impact mechanism of AI on different industries. From the aspect of the impact on the three industries, smart agriculture mainly relies on AI to play a role in the transformation of production tools and the implementation of agricultural production technology under the level of agricultural management to achieve. The realisation of smart manufacturing has the shortcomings of the lack of key components, operating systems, and core technologies, but it is argued both theoretically and empirically that AI can improve manufacturing productivity, product quality, and total factor productivity. However, we still need to face up to the difficulties, increase technological innovation and combination of

DOI: 10.54254/2754-1169/123/2024MUR0143

applications, transform the traditional manufacturing production management and operation mode, through improving the efficiency of the use and allocation of factors of production, organisational and management efficiency and operational efficiency, to create an intelligent manufacturing system with intelligent decision-making and intelligent production as the goal. The main mode of AI-enabled service industry development is 'AI products + traditional service industry scenarios'. From the aspect of production mode, AI can improve labour productivity and achieve industrial upgrading and transformation through knowledge restructuring and tool transformation, thus changing the mode of production; and promote the intensive level of economic growth through technical efficiency and technological progress.

At present, research on the impact of AI on industrial development has yielded numerous results; however, a comprehensive review of existing literature still reveals several future research directions and trends. Firstly, a general theoretical analysis framework regarding the influence of AI on industrial development has yet to be established. Second, the quantitative characterization of AI requires further enhancement. In conclusion, given the uncertainties surrounding future economic growth and the opportunities and challenges posed by emerging technologies—particularly in light of the industrial revolution driven by AI—the study of AI impact on industrial development holds significant implications for promoting high-quality economic advancement through AI.

References

[1] *Russell, S. J., & Norvig, P. (2009). Artificial intelligence: A modern approach (3rd ed.). Prentice Hall.*

[2] *Statista. (2024) AI market size worldwide from 2020-2030 (in billion U.S. dollars). Statista. Retrieved from https://www.statista.com/forecasts/1474143/global-ai-market-size. Accessed 1st September 2024.*

[3] *Kromann, L., Skaksen, J. R., & Sørensen, A. (2011) Automation, labor productivity and employment–a cross country comparison. CEBR, Copenhagen Business School, 1-16.*

[4] *Acemoglu, D., & Restrepo, P. (2018) Artificial intelligence, automation, and work. In The economics of artificial intelligence: An agenda. University of Chicago Press, 197-236.*

[5] *Hanson, R. (2001) Economic growth given machine intelligence. Technical Report, University of California, Berkeley.*

[6] *McAfee, A., & Brynjolfsson, E. (2017). Machine, platform, crowd: Harnessing our digital future. WW Norton & Company.*

[7] *ABB. (2018) Transforming and upgrading manufacturing in the age of artificial intelligence. Retrieved from http://cdf.cdrf.org.cn/qybg/5019.htm?share=ture#content. Accessed September 9, 2024.*

[8] *Accenture. (2017) Artificial intelligence fuelling China's economic growth. Retrieved from http://www.accenture.com/cn-zh/insight-ai-artifical-intelligence-future-growth. Accessed September 9, 2024.*

[9] *Chen, G., Li, J., Chen, H., & An, Y. (2018) Research progress of artificial intelligence technology in agriculture in the era of big data. Journal of Jilin Agricultural University, 40(4), 502-510.*

[10] *Gang, R., Hui, L., & Guilong, S. (2020) Transforming Chinese agriculture with artificial intelligence: theoretical interpretation and institutional innovation. Economist, 4, 110-118.*

[11] *Gao, Y. (2019) Intelligent mode selection for the deep integration of artificial intelligence and manufacturing in China's high-quality economic development. Journal of Northwest University (Philosophy and Social Science Edition), 5, 28-35.*

[12] *Han, B., Hu, D. (2016) Subject Group of Wuhan Branch Office of the People's Bank of China. The application and response of artificial intelligence in the financial field. Wuhan Finance, 7,46-47.*

[13] *Liu, F., Bao, S., Wang, X. (2020) The choice of high-quality development of pension industry in the era of artificial intelligence: basis, motivation and strategy. Journal of Northwest University (Philosophy and Social Science Edition), 2, 150-159.*

[14] *Sun, X.H., Zhang, Y.W., Hou, L et al. (2020) A review of research on artificial intelligence products and service system. Packaging Engineering, 10, 49-61.*

[15] *Wang, X. (2020) Artificial Intelligence Enabling High-Quality Development of Service Industry: Theoretical Logic, Practical Basis and Practical Path. Huxiang Forum, 5, 136-144.*