Research on Measurement and Influencing Factors of Artificial Intelligence Development in China

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Abstract. As a crucial achievement of the emerging scientific and technological revolution, artificial intelligence has become a vital factor to change the economic model and industrial structure. This paper analyzes the importance of the development of artificial intelligence, and on this basis, measures the development trend of artificial intelligence in China by using statistical public data, in addition to further quantifying the influencing factors. Finally, this paper provides some suggestions for developing artificial intelligence in China.

Keywords: Artificial Intelligence; Influencing Factors; China.

1. Introduction

With the development of a new round of scientific and technological revolution, many digital economic models and digital technologies are in consistent development. Up against the progress of artificial intelligence technology and social labor production mode, artificial intelligence and big data-related applications, as important products of scientific and technological development and important tools of labor production, have shown their advantages and convenience for individuals, enterprises, and countries in social production as well as enterprises' information collection and processing. Artificial intelligence has played an important role in economic development and resource utilization (Bai and Zhang, 2020; Li et al., 2023). From the perspective of the enterprise, e-commerce platforms and new media companies collect user data, deliver related content in a targeted manner, and adopt digital management and operation to assist enterprise decision-making. At the same time, the traditional manufacturing industry can use digital technology to reduce the risks in the process of production, sales, and publicity, apart from monitoring the enterprises to prevent the risk of trade secrets being leaked. Enterprises can timely feedback on the upstream and downstream status of enterprises in combination with artificial intelligence platforms to reduce the probability of losses caused by poor information, such as the price of raw materials, the current situation of suppliers, and customers' recent demand for products, so as to improve the sharing and exchange of information and resources to a certain extent, boost healthy competition among enterprises, predict the market trend in the future, and provide certain advantages for enterprises. Secondly, from the perspective of the government, digital technology, as a feasible excellent labor force in the future, can greatly improve the overall economic productivity of the country, which is great progress that the traditional production mode cannot achieve. Meanwhile, the development of artificial intelligence will impact some industries, promote economic development, and provide new jobs. At present, the development of artificial intelligence in China is in a transitional stage, which can play an imperative role in the economic development of developing countries like China. Therefore, different enterprises and countries gradually attach importance to the research of artificial intelligence, actively lay out the potential development in artificial intelligence and big data, develop related applications, and issue supporting policies. The development and application of artificial intelligence have gradually become an important index to measure the production technology and production capacity of enterprises and countries.

However, up to now, we still have some problems and contradictions that can not be ignored in the development of artificial intelligence and related technologies, theories, and practices in China. Therefore, there is still room for research and breakthrough in how to solve the problems of artificial intelligence and big data technology in actual production activities. Few empirical studies exist in this field in China, and the development of artificial intelligence has important practical significance. This

technology is the focus of development at home and abroad now and in the future, based on which this paper may have the following contributions. First, there is a lack of qualitative and quantitative analysis in this field in China. This paper will scientifically evaluate the development of artificial intelligence in China from these two perspectives and assess the possible difficulties in the future. Premised on China's actual domestic conditions and related research in the field of big data, some related data are quantitatively measured and summarized by statistical methods. Secondly, this paper discusses the development status and existing problems of artificial intelligence in China, evaluates its current development in China, and summarizes its influencing factors, so as to give corresponding countermeasures and suggestions for its related industries under the background of big data in China. The aforementioned will enrich the theoretical framework of the development in this field and provide some empirical evidence for the follow-up research to deeply understand the domestic development status. Thirdly, the development of artificial intelligence in China still has many aspects worthy of improvement, and there are some situations that hinder its development. For its smooth development, some necessary measures need to be taken. This paper will provide some practical policy suggestions to provide help for the development of artificial intelligence.

2. Statistical Measurement of Artificial Intelligence in China

2.1 Measure Process

Table 1. Statistical Index System of Artificial Intelligence Development in China

	Indicators
Artificial Intelligence	Financial Investment in Science and Technology (100 million yuan)
	FTE of R&D Personnel in High-tech Industry (person-years)
	R&D Expenditure of High-tech Industry (10,000 yuan)
	R&D Project Funds for High-tech Industries (10,000 yuan)
	Number of Patent Applications for High-tech Industries (pieces)
	Sales Revenue of New Products in High-tech Industries (10,000 yuan)
	Turnover of Technology Market (10,000 yuan)

Index system. Because China has focused on developing artificial intelligence since 2009, this paper refers to the practices of Zhao Fang and Liu Yujia (2020), considering the unity and availability of data to fully show the development status and trend of artificial intelligence in China. This paper uses the artificial intelligence data of China from 2009 to 2020 as the basis of its measurement. All the data come from China Statistical Yearbook. Because artificial intelligence is a comprehensive index system, each index and data can not be simply processed, while the entropy weight method can synthesize multi-dimensional indexes, which is widely used in data analysis. Therefore, this paper uses the entropy weight method to calculate the index system and obtains the national development index of the artificial intelligence industry in China from 2009 to 2020.

2.2 Analysis of Measurement Results

Combined with the index system of artificial intelligence and the entropy weight method, the development of artificial intelligence in China is comprehensively measured, with the results shown in Figure 1. First of all, during the period from 2009 to 2020, we found that Chin's artificial intelligence development index is on the rise, with an average annual growth rate of about 8.15%. This set of data shows that China's artificial intelligence has developed rapidly and significantly in these 11 years. We believe that there are two reasons for this achievement. On the one hand, attaching great importance to the artificial intelligence industry, the Chinese government provides strong

support for its research individuals and organizations in terms of funds and invests a lot of resources towards this research direction. A series of financial support from the government has laid a solid foundation for the follow-up research on artificial intelligence. On the other hand, China has adopted a series of policies since 2015 with "intelligent manufacturing" as the main orientation of its manufacturing in the future. Meanwhile, it proposes to vigorously develop this emerging industry and encourage innovation. In many documents, artificial intelligence is mentioned and emphasized as the key development field. These policies are not only stepping stones in building a high-quality intelligent industry environment and promoting the commercialization of intelligent products and industrial manufacturing, but they also lay a solid foundation for industrial intelligent upgrading and improving intelligent production and service.

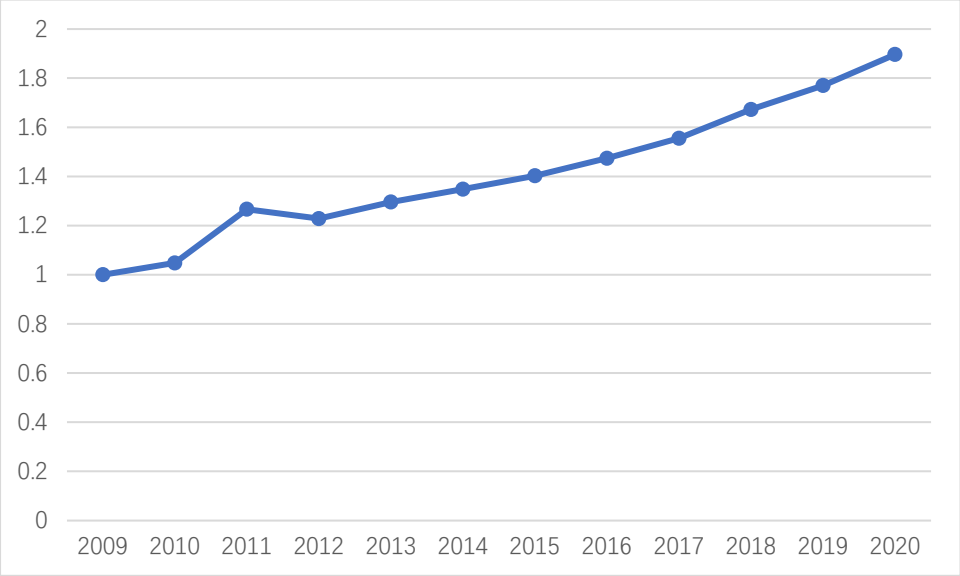


Figure 1. Development of Artificial Intelligence in China from 2009 to 2020

Moreover, we also found that the development trend of artificial intelligence in China has taken a certain turning point in 2011. We believe that the development of artificial intelligence in China received more attention and resources from the government and enterprises in 2011. For example, the emergence of various popular intelligent methods such as the Internet and mobile payment, and the wide application of digital economy models in various industries have led to the rapid development of artificial intelligence in 2011. Therefore, we believe that the above-mentioned series of factors are the main reasons for the rapid development of China's artificial intelligence industry in these years.

3. Analysis of Influencing Factors of Artificial Intelligence Development in China

China's artificial intelligence has been affected by many factors with two different sides to its development, which needs specific analysis. However, because there are too many influencing factors of artificial intelligence, it is too cumbersome and inefficient to bring all those factors into the empirical framework. Therefore, this paper only selects some representative macro factors to discuss and analyze their influence on artificial intelligence. This group of macro factors includes economic growth, industrial structure, opening to the outside world, and fiscal expenditure.

This paper measures the impact of the above factors on the artificial intelligence industry through the following indicators. First, economic growth. Gross product per capita (GDP) can reflect China's economic development when recording data in most cases. Secondly, industrial structure (INDU). This paper uses the added value ratio of the tertiary industry in GDP to reflect the product structure in the field of artificial intelligence. Thirdly, opening to the outside world (TRADE), using import

and export TRADE volume to express the degree of opening to the outside world. Fourthly, the FISCAL factor (FISCAL), which uses the governmental FISCAL expenditure to reflect the FISCAL factor. Taking these factors as independent variables, the artificial intelligence is regressed and finally, all variables are logarithmic.

Table 2 provides the regression results. We find that economic growth is positively correlated with the regression coefficient of artificial intelligence. This shows that China's economic growth can promote the development of artificial intelligence. In addition, there is a negative correlation between industrial structure and the development of artificial intelligence, which shows that the increase in the proportion of tertiary industrial structures cannot develop artificial intelligence in China. This phenomenon is due to the fact that a considerable part of China's industrial structure is backward non-high-tech industries, which cannot provide support for high-tech and digital technologies such as artificial intelligence, and even drag down the development of the overall high-tech industry. Secondly, China's opening-up degree is negatively correlated with the development index of artificial intelligence, so its opening-up degree has not significantly promoted the development of artificial intelligence. This is because the products, technologies, and funds of China's foreign trade are mainly concentrated in the low-end of the global value chain, such as wholesale, manufacturing parts, or commodities, rather than focusing on technology R&D and technological progress. Therefore, the foreign trade demand for China's artificial intelligence industry is relatively small and cannot support the development of artificial intelligence. Finally, the negative correlation between financial factors and the development of the artificial intelligence industry shows that China's current finance has not significantly promoted the development of artificial intelligence.

Moreover, we find that there are some differences in various factors in the development of artificial intelligence. In practical application, it is necessary to further improve the positive impact brought by positive factors and reduce the negative impact brought by negative factors, so as to lay a solid foundation for the progress of the artificial intelligence industry.

Table 2. Analysis of Influencing Factors of Artificial Intelligence in China

	Regression Coefficient
GDP	2.57
INDU	-2.656
TRADE	-0.947
FISCAL	-0.632
Cons	2.328
R2	0.9745

4. Development Path of Artificial Intelligence in China

4.1 Strengthen International Cooperation and Promote Technical Exchanges

With the rapid development of the modern scientific and technological revolution, countries all over the world are more closely linked. Especially in the era of rapid development of the Internet, big data, artificial intelligence, technical exchanges, and cooperation between different countries are very necessary. However, the development of artificial intelligence in China is still in its infancy, and the development of artificial intelligence has not yet reached a very high level, with a certain gap compared with developed countries. Therefore, the development of artificial intelligence in China needs more investment in technology and capital, and international exchanges should be strengthened. With the increasingly inseparable relationship between China's economy and the world economy, China will have more frequent technical exchanges and cooperation with other countries in the world. In this process of exchange and cooperation, China should increase investment in scientific research,

introduce more advanced technologies, learn from developed countries with an open mind, and seize opportunities for cooperation and exchange, especially in the fields of artificial intelligence and digital technology. At the same time, China can actively build an international cooperation and exchange platform for artificial intelligence, providing more opportunities for the exchange of artificial intelligence technology among countries. Moreover, China can also complete some links of international technical exchanges through various opening-up measures, foreign capital utilization, trade, and other means.

4.2 Strengthen Policy Support and Create a Good External Environment for the Development of Artificial Intelligence

The government should actively introduce the development plan for artificial intelligence and promote its development step by step. All regions should formulate plans for the development of artificial intelligence in combination with regional development reality and economic characteristics. For example, eastern China has a good economic foundation and scientific research environment, while developing artificial intelligence locally may have greater advantages. Therefore, we can give full play to the advantages of regional technology and actively catch up with or even surpass the development of artificial intelligence in developed countries. However, the industrial base of artificial intelligence in the central and western regions of China is still relatively weak, so the main strategy of the central and western regions at present should constantly improve the local economic growth and industrial base, so as to lay a solid foundation for the future development of artificial intelligence in the local area. In the process of vigorously developing artificial intelligence in China, different regions should give full play to the guiding role of fiscal, financial, and taxation policies, increase financial input and policy support to the artificial intelligence industry, help more enterprises complete digital transformation, and use advanced digital technology and artificial intelligence to assist enterprises in production and innovation, so as to continuously improve the development quality of China's advanced technology enterprises.

4.3 Cultivate Artificial Intelligence Talents & Provide Scientific and Technological Talent Support for the Development of Artificial Intelligence

First of all, universities and related research institutes should take the cultivation of advanced talents in artificial intelligence as the development direction of their schools. They should also fully combine the characteristics of the digital economy development to make the theory and practice of artificial intelligence more accessible to more students, thus continuously improving their comprehensive quality. Secondly, the government should strengthen labor training. It can transform the traditional production mode of employees, let more employees learn and apply some artificial intelligence and digital technologies, improve the utilization rate of digital technology in the production of enterprises, and further improve the production efficiency of enterprises. Moreover, with the continuous transformation and upgrading of China's traditional manufacturing industry to high-tech and digital fields, we have reason to believe that even in the development of the traditional manufacturing industry, more artificial intelligence talents are needed. Therefore, strengthening the training of talents in the related fields of artificial intelligence is conducive to meeting the needs of enterprises for talents in this direction, providing some necessary high-tech talents for enterprises and promoting the progress of enterprises. Finally, we need to strengthen the deep cooperation between artificial intelligence and other fields, and reconstruct the development model of labor input and capital investment that traditional industries rely on. Although this traditional development mode can improve the economic benefits of enterprises, the overall development efficiency is low. Therefore, in order to further improve the development and production efficiency of enterprises, it is necessary for us to attach importance to and strengthen investment in artificial intelligence in three aspects, including policy, education, and enterprise management planning.

5. Discussion and Conclusion

The development of artificial intelligence has become an important way to lead future economic and social development. Its development and popularization will inevitably subvert the current production and life mode of human beings in the future. In addition to focusing on the significance of the development of artificial intelligence and scientifically measuring the current situation of artificial intelligence development in China, this paper statistically analyzes the possible influencing factors on the development of artificial intelligence in the data obtained in this paper. On this basis, some suggestions are put forward for future research and development in this field.

With the continuous improvement of China's economic development, artificial intelligence will also play an increasingly important role in high-quality economic development. Artificial intelligence can not only become a crucial driving force for industrial development and residents' living, but also affect national defense, military affairs, resource exploitation, and other aspects. Future research can try to evaluate the development of artificial intelligence in various countries, which can also take China as an example to further explore the development of artificial intelligence in different provinces or cities. At the same time, we can try to explore more factors to analyze the development mechanism of artificial intelligence in China, expecting more data to be published.

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