Research on Potential Risk Prediction Method of Manufacturing Industry Based on Global Value Chain

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Abstract. With the continuous development of intelligent manufacturing industry, the new generation of information technology represented by artificial intelligence has been widely and deeply infiltrated into the manufacturing industry, and has a profound impact on its global value chain status. This paper studies the impact of intellectualization on the global value chain status of manufacturing industry, analyzes the mechanism of the impact of different intellectualization on the global value chain status of manufacturing industry by using the index calculation method, and studies how to improve the intellectualization level of China's manufacturing industry, promote the global value chain status of manufacturing industry with intellectualization, improve the technological innovation ability, enhance the global value chain status of manufacturing industry, give full play to the trade cost saving effect of intellectualization, enhance the position of manufacturing industry in the global value chain.

Keywords: manufacturing Intellectualization; artificial intelligence; Global value chain position

1 Introduction

With the further development of economic globalization, the division of labor system of global value chain led by transnational corporations in developed countries has been deepened, and global value chain has become the paradigm of international production [1-3]. In this context, more and more countries rely on their comparative advantages in specific links to integrate into the global value chain in order to benefit from globalization. Especially in some developing countries, participation in the international division of labor system not only improves economic efficiency, but also promotes domestic employment. However, at present, most developing countries are mainly engaged in the middle and low-end links of the global value chain, obtaining weak profits, and facing the problem of "low-end locking" of the value chain. As an important developing country, China has rapidly integrated into the global manufacturing production network by virtue of abundant and cheap labor and other compara-

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tive advantages, engaged in low-tech production links, and occupied a place in the global manufacturing industry. However, as European and American industrial powers implement the strategy of "Reindustrialization", they compete for the commanding height of industrial competition and the leading position of manufacturing industry in the global value chain, and some newly industrialized countries actively embed themselves in the global value chain through labor resource endowment, forming homogeneous competition with China. The global value chain of China's manufacturing industry is facing great challenges, and the transformation and upgrading of the manufacturing industry is imminent [4-6]. China's "14th five year plan" emphasizes that it is necessary to promote the technological transformation, optimization and upgrading of the manufacturing industry, realize the fundamental transformation of the manufacturing industry model, and promote the global value chain to climb [7].

Innovation is the core of the high-quality development of the manufacturing industry. Intelligent manufacturing with digital and intelligent characteristics is an important way and key content for China to drive the high-quality development of the manufacturing industry with innovation and accelerate the progress to the middle and high-end of the global value chain. This paper analyzes the development status of manufacturing industry intelligence and global value chain status in sample countries and regions, reveals the impact mechanism of intelligence on manufacturing industry global value chain status, empirically analyzes the impact and action mechanism of intelligence on manufacturing industry global value chain status, and puts forward corresponding policy suggestions on how to improve China's global value chain status in the context of manufacturing industry intelligence, which has high theoretical and practical significance.[8-10]

As early as the 1980s, foreign scholars began to explore the connotation of intelligence. Wright and Bourne put forward the concept of intelligent manufacturing for the first time, and defined it as the realization of small-scale production by intelligent machines without human intervention, and the optimization of production processes through computational modeling. With the rapid development and wide application of intelligent technology, the connotation of intelligent manufacturing is constantly enriched. Andrew and David believe that intelligent manufacturing refers to the simulation of human brain's thinking mode and processing mode through advanced and powerful computers in the production process, so as to complete a series of important tasks such as analysis and decision-making [11]. At the same time, intelligent equipment is used to replace mechanical and tedious physical activities, or to add bricks to human intellectual activities. Davis et al. believes that intelligent manufacturing is the in-depth application of information technology in manufacturing enterprises and supply chain, which can improve the competitiveness and performance of manufacturing enterprises by responding to the needs of customers and partners in real time. Intelligent manufacturing from the perspective of technology, pointing out that intelligent manufacturing is supported by artificial intelligence, big data and other technologies, and completes a series of work such as product research and development, production and management in the form of human-computer interaction, which is an objective reflection of the deep integration of the two. From the perspective of industrial development, the intelligent manufacturing industry is the process of the change of industrial organi-

zation form, which is manifested in the advanced evolution of the scientific and technological level and industrial structure of the manufacturing industry, and finally the result of the intelligent transformation and upgrading of the whole industrial chain of the manufacturing industry. Intelligent manufacturing is simply an intelligent human-machine interaction system built by intelligent machines and professionals in cooperation. It can implement a series of standardized and orderly intelligent activities in the production process, and ultimately realize the comprehensive intellectualization of the manufacturing industry [12]. The intelligent manufacturing industry is a process of applying ICT technology and AI technology to comprehensively and deeply intelligent transformation of enterprise production and manufacturing, realizing the intelligent upgrading of manufacturing production mode, and thus generating economic and social benefits [13-14].

2 Establishment of risk prediction model

In material science and metallurgy, toughness refers to the resistance of a material to fracture when it is subjected to a force that causes it to deform [15-16]. It is defined as the ratio of the energy absorbed by the material before fracture to the volume. The larger the volume of a material with the same toughness, the more energy it absorbs before it is damaged. The urban system resilience refers to the ability of the urban system to keep its key functions unaffected or recover quickly when it is impacted by the external environment [17-18]. The higher the complexity of the urban system (determined by the size of the city, the total economic volume and the volume of potential risk sources), the stronger the urban security governance capability is required to absorb or dissolve more external shocks, so as to meet the toughness requirements of the urban system. Therefore, this paper characterizes the status of urban safety development from the concept of "resilience", and uses Si to represent the index of urban safety development, which is defined as:

$$SI(B,G) = \frac{B(U,E,C,S)}{G(\mathrm{L,P,D,M,R_1,R_2})} \tag{1}$$

In the above formula, it is the index of safety development of manufacturing industry; B is the basic index of safe development of manufacturing industry; G is the governance capacity index of manufacturing industry development; S. Are the sub indexes calculated by the index.

① Data preprocessing

Firstly, normalize the original indicators and adopt the linear function normalization method:

$$\mathrm{X_{norm}} = \frac{\mathrm{X-X_{min}}}{\mathrm{X_{max}-X_{min}}} \tag{2}$$

②Calculation of index

$$X_{(i-1)k} = \sum_{j=m}^{n} w_{ij} X_{ij} \tag{3}$$

In the formula: $X_{(i-1)k}$refers to the index of $i-1$level and index; w_{ij}Is the weight of level and index; m. N is the starting label corresponding to the next level index included in the index.

When the index value of the base year is used as the benchmark to compare the growth rate of the index, in order to avoid the distortion of the whole index system due to the high (or low) growth rate of some indicators, the benchmark value of the index growth rate is set as the two-year average value of the index in the calculation process of the safety development potential index of the manufacturing industry system. The indicators are divided into "positive indicators" and "negative indicators". The inverse indicators need to take the reciprocal before calculating the indicator growth rate. The calculation method of value chain growth rate of each index in adjacent years is as follows:

$$V_{it} = \left[\frac{X_{it}-X_{it-1}}{(X_{it}+X_{it-1})/2}\right] \times 100 \tag{4}$$

In the above formula: V_{it} is the index growth rate; I is the index serial number; T is the year,

The global value chain index synthesis method is divided into the following three steps:

① Calculate the weighted growth rate of the indicators under the jurisdiction of level 3 items

$$C_t = \sum_{i=1}^{k} w_i \times V_{it} \tag{5}$$

In the above formula, C_t is the weight of each indicator to its secondary item; K is the number of indicators in the second level item;.

② Calculate the cumulative secondary index of fixed base:

$$E_{t+1} = E_t \times \left(\frac{200+C_{t+1}}{200-C_{t+1}}\right) \tag{6}$$

In the above formula, E_{t+1} is the base cumulative secondary index sub index; T is the year,

③Calculate the sub index of the fixed base cumulative primary index:

$$F_{t+1} = \sum_{i=1}^{l} o_i \times E_{i,t+1} \tag{7}$$

In the above formula,o_i is the weight of each secondary indicator to its primary indicator; L is the number of secondary indicators within the primary indicator

Formulas (4) ~ (7) are respectively used to calculate the fixed base cumulative weighted growth rate of the value chain index of the safe development of the manufacturing industry system. Then the value chain development potential index is calculated by formula (8)

$$PI(B', G') = \frac{B'(U', E', C', S')}{G'(L', P', D', M', R'_1, R'_2)} \tag{8}$$

3 Experimental analysis

This experiment uses a 64 bit computer system, and is equipped with 256 GB memory, 4 TB hard disk and other hardware to build an experimental environment.

In the process of this experiment, three manufacturing enterprises in a certain region are selected to verify the risk using the method proposed in this study, and these three regions are used as comparative experiments. In order to verify the global value chain calculation method proposed in the paper, during the experiment, the trend of the value chain index of the three regions and the actual situation were compared to reflect the superiority of the design method in the paper, as shown in Fig. 1.

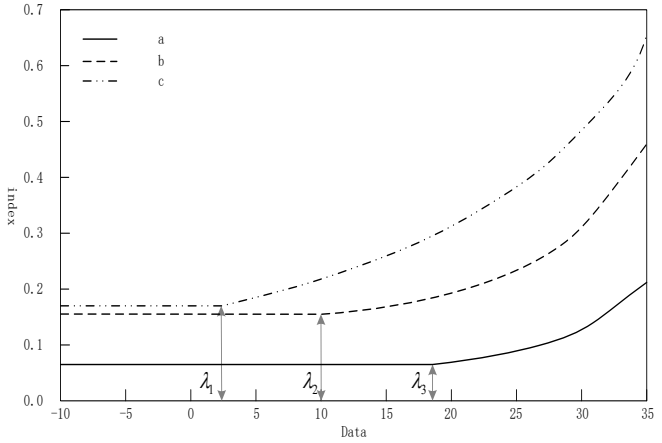

Fig. 1. trend of manufacturing value chain index

Through in-depth analysis of the research process, we can know that the improvement of technological innovation capability is an important way to enhance the position of manufacturing industry in the global value chain, but this way plays a small role. Therefore, it is necessary to give full play to the role of technological innovation in promoting the status of manufacturing industry in the global value chain. First, enterprises should increase investment in intelligent transformation. In the process of continuous penetration and development of intelligence into manufacturing enterprises, we will accelerate the emergence of new technologies and knowledge, enhance the ability to learn and absorb knowledge, accelerate the creative reorganization of new and old knowledge, and improve the ability of technological innovation. At the same

time, it is necessary to establish economic ties with intelligence as a link, promote the rapid transfer and diffusion of intelligence among enterprises and industrial departments, strengthen the spillover effect of knowledge and technology, make the technological innovation capability continuously improve, and realize the global value chain of manufacturing industry. Secondly, human capital, as an important factor affecting technological innovation ability, needs to strengthen the training of relevant skilled personnel and human capital from the government, enterprises, universities and other levels

To expand the supply of high skilled labor, promote the mutual matching of high skilled labor and intellectualization, give play to the collaborative innovation effect of high-end factors, realize the transformation of manufacturing industry from traditional factor driven to "innovation driven", and inject strong power into the technological innovation of manufacturing industry. Finally, the government should create a good innovation atmosphere. Actively build an innovation service platform to better promote the industrialization and application of scientific and technological achievements. We will improve the intellectual property protection mechanism and maintain the market order, so as to mobilize the enthusiasm of enterprises for technological research and development and improve their ability of independent innovation.

4 Conclusions

In generally, this paper has basically achieved the expected research objectives, but it has not yet studied the impact mechanism of intelligence on the global value chain status of manufacturing industry from the perspective of theoretical models. The mechanism analysis is not guided by relevant mathematical models to deduce the impact of intelligence on the global value chain status of manufacturing industry, resulting in insufficient theoretical explanation. The text analysis method has certain subjective color, so the innovation of this paper is slightly weak. Therefore, in the further study, we can build relevant mathematical models to deduce the conduction mechanism. At the same time, the measurement index of manufacturing industry intelligence needs to be discussed. The existing research has not reached a consistent conclusion on how to measure the level of intelligence. In this paper, we use the data of industrial robots to measure the intelligent level of manufacturing industry. However, the connotation of manufacturing intelligence is relatively rich. Only using industrial robot indicators may not be able to comprehensively measure the level of manufacturing intelligence. At the same time, there may be a problem of self selection of indicators in the self built indicator system.

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