

Discussion on the Possibility of Catching up with Intelligent Manufacturing Technology in China

-Based on A-U Model

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Abstract

In order to have a more comprehensive and systematic understanding of the development of intelligent manufacturing technology and better restore the development process of intelligent, understand the possibility of China catching up in intelligent manufacturing technology. This article will combine the literature study, comparative study, theoretical analysis method to explore the development of intelligent manufacturing technology, will also according to the maturity of intelligent manufacturing technology and combined with A - U model of technological innovation in its development history can be divided into liquid phase, phase transformation, professional stage three stages to the dialectical analysis of understanding the past and current situation of development of intelligent manufacturing technology. Through analyzing the development of world intelligent manufacturing technology, compared to the United States and some European countries the development of intelligent manufacturing technology, and combining with four manufacturing changes in the industrial revolution, find out the opportunity and obstacle to China's development of intelligent manufacturing technology, and combining with the condition of its recommendations possibility to fit the development of intelligent manufacturing technology in China.

Keywords

Intelligent manufacturing technology; Industrial revolution; A-U model; Technology innovation.

1. Introduction

Intelligent manufacturing is a hot word we are familiar with now, so what is intelligent manufacturing. Different scholars have different understanding of intelligent manufacturing. Each country should define the concept of intelligent manufacturing according to its national conditions^[1]. According to China's national conditions, intelligent manufacturing should have prospective practicability^[2]. So for China, intelligent manufacturing technology refers to the integration of advanced manufacturing technology and the new generation of information technology. It includes three basic paradigms: digital manufacturing, "Internet +" manufacturing, and digital networked intelligent manufacturing^[3]. At present, China is in the transition stage from Internet + to digital networking, so China has not really entered the stage of intelligent manufacturing. So how to enter the era of truly intelligent manufacturing. Therefore, it is important to recognize the characteristics of intelligent manufacturing. The characteristics of intelligent manufacturing are comprehensive interconnection, data-driven, information physical integration, intelligent independence and open sharing. The development trend

of intelligent manufacturing will mainly focus on intelligent manufacturing, digital twin and large data in life cycle ^[4]. At present, China's intelligent development is not comprehensive. Intelligent manufacturing technology is mainly used in discrete manufacturing fields such as machinery, aviation, aerospace, automobile, ship, light industry, clothing, medical equipment, electronic information ^[5]. Only when a complete intelligent manufacturing system and intelligent chemical plant are established in these fields, can our country truly declare to enter the era of intelligence. Of course, intelligent manufacturing technology does not only refer to the intelligent technology. Intelligent manufacturing also includes the intellectualization of mechanical production process, production management mode and mechanical production products ^[6]. Most of the existing research focuses on the shortage of intelligent manufacturing technology and the future development trend. Some people think that the main problems in China are lack of innovation ability, lack of core technology and lack of high-end equipment ^[7]. The problem of the development of intelligent manufacturing technology lies not only in technicians and equipment, but also in the management. Others think that the most prominent disadvantage of our country at present is the lack of management experience and research and development investment in information organizations ^[8]. According to the existing data, China's R & D investment ratio accounted for 2.1% in 2015, 2.13% in 2017, and is expected to reach 2.5% in 2020. Although the gap between China and the United States and other countries with developed science and technology in total R & D investment is gradually reducing, but due to China's late start, the level of intelligence is far from the development level of the United States. For the future development trend of intelligent manufacturing technology in China, the current research focuses on performance and industrial model. Most researchers believe that in the future, intelligent mechanical manufacturing will be high-speed, efficient and flexible in performance, and tend to be integrated, modular and networked in Architecture ^[9]. It is worth noting that with the development of performance and industrial model, health and environmental protection is also a major theme of development. As far as the current situation is concerned, the United States and Europe have issued relevant regulations and goals for intelligent manufacturing technology, and China has also made some plans and established pilot projects ^[10]. However, there are still many difficulties in the development of intelligent manufacturing technology in China. Our country does not pay enough attention to basic research, excessively relies on imitation and introduction, and lacks original innovation in basic research ^[11]. His view has also been proved by relevant data. According to the report of the national science and Research Commission of the United States, by the beginning of 2018, China's annual R&D investment was second only to that of the United States, accounting for about \$409 billion, accounting for 21% of the world's total. However, the gap between China and the United States is still huge. The main reason is that China only spends 5% of its R&D funds on basic research, while the United States spends 17% R & D funds are used for basic research.

The major output countries of papers related to intelligent manufacturing technology in foreign countries are mainly the United States and Germany, which are the first countries to propose and enter intelligent manufacturing, and also the countries with the best intelligent development. Therefore, their research on intelligence is more in-depth than that in China, and the domestic research now stays in the analysis of the general theory. Different from the domestic research, most of the foreign research on intelligent manufacturing technology will go into a specific aspect in detail, such as the specific application of intelligent manufacturing technology in medical, agricultural and other fields. In addition, foreign research focuses more on practice than theory.

2. Application Scenario of the Model

2.1 A-U Model and Its Characteristics

In order to study and analyze the characteristics of each stage of intelligent manufacturing technology more rationally and truthfully, based on the existing literature, this paper will combine the case and A-U model for comprehensive analysis. The so-called A-U model is based on the product life cycle theory, which reveals that the dynamic development of product innovation, process innovation and organizational structure in time affects the evolution of corresponding industries to different stages.

According to the different linear changes of process innovation and product innovation, it is mainly divided into flow stage, transformation stage and specialization stage. As shown in the figure.

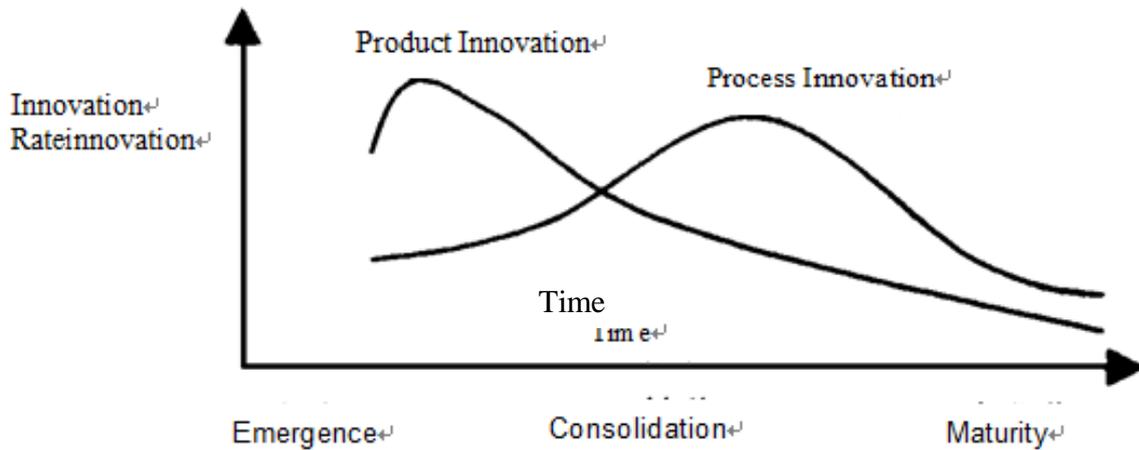


Fig.1 A-U model

The main advantage of A-U model is that it reflects the changes of an industry through linear product innovation and process innovation. When product innovation reaches the peak, product innovation can no longer be carried out. At this time, in order to improve market competitiveness and attract consumers, only in the aspect of technology innovation can make products more unique. Therefore, product innovation began to decline and process innovation began to develop. When the level of product innovation and process innovation is almost the same, the product begins to formally transform from product innovation to process innovation. Finally, when the process innovation reaches the peak, it will begin to decline. At this time, both the process innovation and the product innovation are in the decline period, and the product is also mature in this period. The disadvantage of A-U model is that in the long run, the same core technology will have different sets of innovative technologies. Specifically reflected in the chart should be a cluster of curves, not just a single one.

According to the maturity of process innovation and product innovation and product life cycle theory, A-U model has different characteristics in different stages. The characteristics of A-U model are as follows:

2.2 Application of the Model

The same as most of the existing researches is that this paper will use historical method and literature reference method to analyze the development of intelligent manufacturing technology, then analyze the advantages and disadvantages of China in intelligent manufacturing technology, and put forward some suggestions according to China's national conditions, then make reasonable reasoning and outlook for its future development.

From the existing literature, we can see that the research focuses at home and abroad are not the same. The existing research at home focuses on the future development direction of intelligent manufacturing technology and the existing problems of energy manufacturing technology. Although the research focuses on these two aspects, they are relatively scattered from the entry point. These researches are more about the analysis of intelligent manufacturing technology from the point of view of technology. The related problems of technology are not analyzed with the development history of intelligent manufacturing technology in the world. Foreign countries pay more attention to practical research. This paper will analyze the development of the whole manufacturing industry from the historical line, which is relatively coherent. At the same time, we will use the A-U innovation model in economics to divide the development of intelligent manufacturing technology into three stages: flow stage, transformation stage and specialization stage based on the three technological evolution processes of

digitalization, networking and intelligence. Then we will analyze the characteristics of each stage according to the different product innovation rate and process innovation rate of each stage, and give some examples to verify its characteristics.

Table 1 Characteristics of A-U Model

	Emergence	Consolidation	Maturity
Innovation	New products continue to appear	As demand increases, major processes change	Gradually mature products, improve product performance and quality, and achieve the best
Sources of Innovation	Industry leader; User demand	Manufacturer; User	Supplier
Product	Diversified design, usually customized	At least one product design is stable and can achieve high output	Based on standard products without difference
Production and Process	The production is flexible and the efficiency is low.	Production becomes more fixed, and process changes occur in main processes	Effective, capital intensive, fixed, high cost of change
Research and Development	Due to the high degree of technical instability, it is not concentrated in a certain specialty	Once there is a leading design, focus on specific product features	Emphasis on process technology
Equipment	General purpose type, requiring skilled workers	Some process automation, local automation	Dedicated; automated, more human resources for equipment maintenance and monitoring
Factory	Small scale, located near users or innovation sources	General, but with a professional department	Large scale, highly specialized products
Process Change Cost	Low	Middle	High
Competitor	Very few, but as market share changes dramatically, the number increases	Many, but after leading design, the number is reduced	Few, traditional monopoly, stable market share
Basis of Competition	Product performance	Product variation; practical suitability	Price
Organizational Control	Informal, entrepreneurial	Rely on projects and task forces	Structure, objectives and planning
Vulnerability of Industrial Leadership	Facing the challenges of imitators and patents; facing the successful product breakthrough	Facing more effective and higher quality producers	Excellent substitutes for technological innovation

3. A-U Model Analysis of Intelligent Manufacturing Technology Innovation: Comparison Between China and Foreign Countries

3.1 Technological Innovation in the Mobile Stage

In the flow stage, product innovation has experienced three stages: development, maturity and decline, while process innovation is in the initial development stage. In this stage, the product is updated

quickly, and the product form and function are changeable, so it is often poor in quality and user experience comfort, but it can meet the needs of customers in a certain direction, such as quantity. At this time, due to the emergence of technology for the first time and the fact that most of these technologies rely on human resources in implementation, they are often expensive, rough and unreliable, and the products are generally very cumbersome.

We can see clearly from the history of the world industrial revolution and the development history of manufacturing industry that the third industrial revolution has brought human beings into the information age. Of course, the biggest contributor of the third industrial revolution is the computer. During this period, the world's manufacturing industry, especially the rapid development of industry, the digitalization and networking of intelligent manufacturing technology are developed in the third industrial revolution. Digitalization refers to the transformation of information into digital information, and then the introduction of computer for unified processing, while networking refers to the combination of advanced network technology to organically link product design, production, manufacturing and sales, break the constraints of space, realize the sharing of enterprise and social resources, so as to improve the response speed of the market and meet the personalized needs of customers. During the third industrial revolution, the product innovation of manufacturing industry has gone through the whole process from prosperity to decline. Hundreds of thousands of products such as mobile phones, home appliances, aerospace equipment, medical devices, etc. have emerged in this era, and manufacturing processes such as CNC machine tools, automatic programming tools, computer-aided design have also begun to appear for the first time and applied to manufacturing industry. The third industrial revolution can be said to be a hands-free revolution in the manufacturing industry. It connects the computer industry with the manufacturing industry. The traditional manual manufacturing can no longer meet the development needs of intelligent manufacturing technology. Machinery began to replace the manual, and the manufacturing industry gradually developed to intelligent.

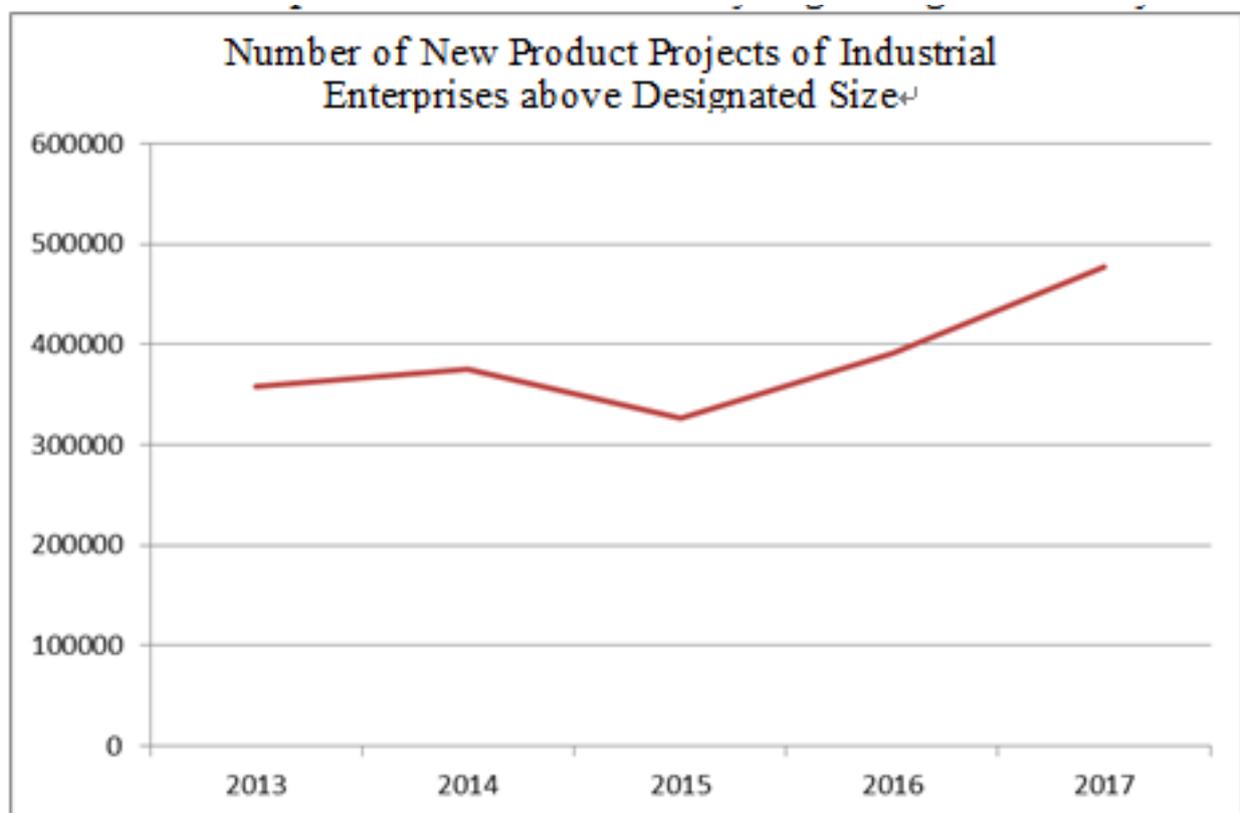


Fig.2 number of new products above Designated Size from 2013 to 2017 (data source: National Bureau of Statistics)

Due to historical reasons, China entered the digital era later. In the 1980s, after the reform and opening up, it began to enter the first stage of intelligent manufacturing technology. Refrigerators, washing machines, mobile phones, color TVs, etc. were also introduced into China at that time, and a variety of manufacturing products are springing up. Because most of the products are the first time in China, there are few competitors in the market, and they have a large share in the market. Gradually, a large number of competitors began to appear, and different brands, appearances and functions appeared in the same product. The increase of competitors is a driving force for product improvement. At the same time, the demand of consumers has begun to change, and they have begun to pay attention to the performance and quality of products. This makes enterprises have to change their manufacturing process so that their products are not eliminated. As shown in the figure below, the number of industrial products in China has only begun to grow steadily in recent years.

3.2 Technological Innovation in the Mobile Stage

Innovation is no longer inspired by industry leaders, but by the needs of consumers. In addition, the market leader does not have an absolute advantage at this stage. This stage is the easiest to be eliminated and the easiest to enter the market. Many market leaders are easy to fall behind at this stage. For example, Motorola was acquired because its mobile phone system failed to catch up with the changes in the market. There will be a leading design in this stage. Once the leading design is determined, the production will become relatively fixed, and the main change of its manufacturing technology will occur in the manufacturing process.

At the beginning of the 20th century, when the development of manufacturing products reached its peak, people began to seek changes in manufacturing technology. In 2013, Germany proposed industry 4.0, the fourth industrial revolution, and the intelligent manufacturing technology ushered in the transformation stage. Products are no longer the mainstream of innovation, and reducing production costs through economies of scale and labor cost saving is no longer the main problem that manufacturers consider. How to shorten the production cycle of products through better manufacturing process and meet the personalized needs of more customers has become the leading problem of manufacturing industry. In the transformation stage, cloud computing, big data, virtual currency and other emerging technologies began to be used in the production process. In the process of production, the boundary between reality and virtual is no longer clear. All the procedures of manufacturing can be designed in computer in advance, and then simulation can be carried out to complete the analysis and optimization of production. Artificial is almost completely replaced by machines. Enterprises will realize intelligent production and establish intelligent chemical plants.

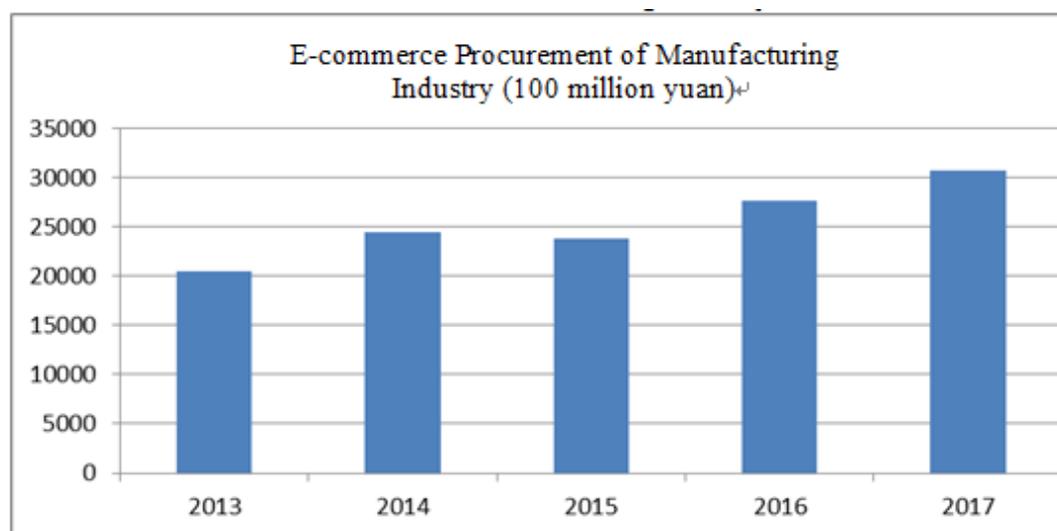


Fig.3 E-commerce procurement volume of China's manufacturing industry (data source: National Bureau of Statistics)

China's e-commerce is developing rapidly around 2010, and e-commerce is a platform for China's intelligent manufacturing technology to overtake cars in a corner. The development of intelligent manufacturing technology is not only a unilateral problem of manufacturing industry, it needs a more comprehensive overall layout, in which it is very important to understand the needs of users and communicate with customers in real time, and the e-commerce platform well meets this point. Obviously, the development of China's e-commerce is among the best in the world. According to statistics, online shopping generated about \$1.1 trillion in revenue in China in 2017, an increase of 32% year on year. China is the world's largest e-commerce market and is far ahead of other countries, including the United States (\$450 billion), Japan (\$95 billion) and the United Kingdom (\$110 billion). Once someone interviewed the buyer of a well-known e-commerce platform in China. When everything goes well, a product can be finished in about a week from design, production to delivery, which is what industry 4.0 looks like. So although China's intelligent manufacturing technology started late and developed slowly, China can catch up with other developed countries with the advantage of e-commerce. The development prospect of e-commerce in China's manufacturing industry is also worth looking forward to. The figure below shows the purchase volume of e-commerce in China's manufacturing industry from 2013 to 2017.

From the data of these years, we can see that e-commerce has made great contribution to the development of China's manufacturing industry. The development of e-commerce in China is very rapid, and e-commerce platform is a major way to achieve a breakthrough in manufacturing industry.

3.3 Technological Innovation In the Stage of Specialization

In the mature stage of intelligent manufacturing technology, the product itself and manufacturing process have been mature, the performance and quality of products have reached the best, and there are few competitors in the market. The source of enterprise innovation is no longer the needs of customers, but manufacturers. At this time, we all provide products with almost no difference in appearance. From the perspective of the whole world, industry 4.0 has just started, the technological innovation of manufacturing industry has not reached its peak, and the maturity of intelligent manufacturing technology is far from the level of specialization. According to the existing data, Germany has the best development of intelligence, but its intelligence has only been popularized in agriculture, and the industrial 4.0 plan proposed by Germany aims at the penetration of intelligent manufacturing technology into industry. So the specialized stage of intelligent manufacturing technology has not really come. We can imagine that when the stage of specialization really comes, the user is the manufacturer itself. From design to logistics, only the user needs to complete on the mobile port, and personalization becomes the consumer's daily consumption. Almost all links of the manufacturing plant are only completed by machinery, and the production cycle of products is greatly reduced. Only a few managers and equipment maintainers are needed in the plant, and many new modern posts will appear.

At this stage, most of China's intelligent manufacturing technology is still in the mobile stage, but it is just around the corner for China to realize the leap from the mobile stage to the professional stage with the help of a huge database and existing e-commerce platform. In addition, with the growing maturity of China's international R & D network, the catch-up speed in intelligent manufacturing technology is also constantly improving, so China will realize the bend in this stage Overtaking is just around the corner.

The development of intelligent manufacturing technology is inseparable from the Internet, and in the past five years, China's Internet broadband users have reached 350 million, according to the world's first.

In addition, the innovation ability of China's industry is also constantly improving. From 2013 to 2017, the number of patent applications for industrial enterprises above Designated Size in China has been increasing year by year. In 2017, China proposed the goal of building an innovative country, and the innovative country refers to the country that promotes economic development with

technological innovation. So, it is the most urgent demand for the development of intelligent manufacturing technology to increase technological innovation in China.

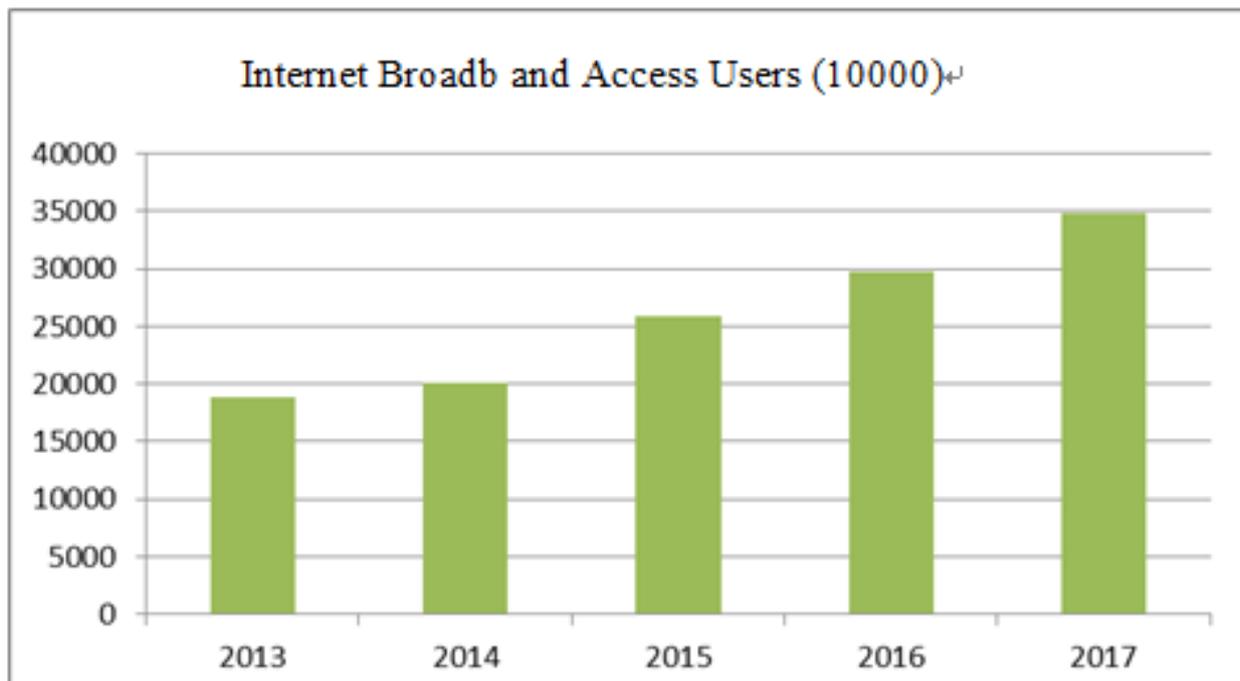


Fig.4 2013-2017 Internet broadband access users (data source: National Bureau of Statistics)

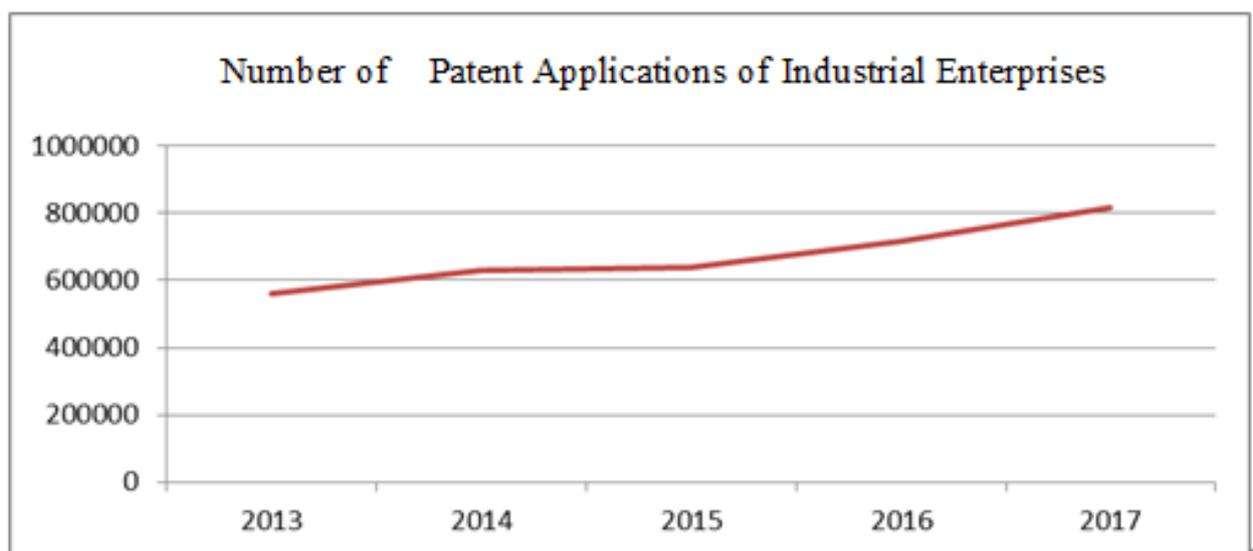


Fig.5 Number of Patent Applications of Enterprises above Designated Size in China (data source: National Bureau of Statistics)

4. Catching up of China's Intelligent Manufacturing Technology Innovation: Possibility Discussion

4.1 Catch up Opportunities

Based on the population base and geographical location of our country, our country has certain human and resource advantages in the development of intelligent manufacturing technology; however, due to the late start of intelligent manufacturing technology, our country will also face certain difficulties. There are all kinds of manufacturing industries. China has the most complete industrial system in the world today, with 41 industrial categories, 191 medium categories and 525 small categories. It is the only country in the world that has all the industrial categories in the UN Industrial Classification.

That is to say, all industrial products of SHANGDA Aerospace can be produced in China. A complete industrial system has laid a good foundation for the development of intelligent manufacturing technology in China, which is conducive to reducing production costs and improving China's competitive advantage. Rich in resources; China has a vast territory, rich in human resources and mineral resources, which are powerful logistical support for the development of intelligent manufacturing technology; I think this development mode is a forward-looking strategy for the development of industry university research cooperation. The students in the campus get substantial exercise. Only the substantial operation can cultivate the innovation ability. The cooperation between enterprises and schools is the driving force to stimulate industrial innovation. China has become one of the top 20 most innovative economies in the world in the latest global innovation index released by Cornell University, INSEAD and the world intellectual property organization. This is closely related to the cooperation between industry, University and Research Institute; China has the largest database in the world. Intelligent manufacturing technology needs to collect, analyze and sort out information. The more information we get, the more accurate the technology will be. But the database of our country has a huge amount of information, which can achieve this well.

4.2 Catch up Obstacles

Generally speaking, China's intelligent manufacturing technology is in the backward level in the world, which is at a disadvantage in many aspects, mainly reflected in the following aspects.

The dependence of imitation. China's intelligent manufacturing started late, and many technologies started from imitating other countries. But in the long run, our country lacks innovation in technology, and the dependence on imitation makes us inert. This makes us subject to other countries in many ways and have no say in innovative technology. Intelligent manufacturing technology is a technology integrating information and network, especially in the era of industrial Internet of things, innovation is particularly important. Although China's innovation index is in the top 20 in the world, there is still a big gap compared with the countries in front; the management experience is insufficient, the intelligent manufacturing technology mentioned above will also be applied to production management. But China's manufacturing industry started late, lacking advanced management experience, the traditional manufacturing industry is more labor force management, and the management mode is relatively single management mode is relatively fixed, there is not much technology. Intelligent technology integrates modern technology into manufacturing industry, so the production mode of manufacturing industry has changed, which requires more advanced management experience. Most of China's well-developed brands are international enterprises, while national enterprises are at a disadvantage; the original high-end equipment is lacking, and China's high-end equipment is basically dependent on imports. Take medical devices as an example. In 2017, the top ten manufacturers of global sales were Medtronic, Johnson & Johnson, Ge, Siemens, Abbott, Philips, Stryker, Roche, BD and poco (data source: China Medical Device Industry Association). The products of these manufacturers have a high degree of automation and perfect application functions, and have greater advantages compared with domestic products. The primary reason is that the core technology is in the hands of foreign enterprises, so the precision of the equipment is much higher than that of domestic enterprises. Domestic institutions prefer to import when funds permit; regional development gap is wide. China's intelligent development is in a stepped distribution, with the eastern and coastal regions taking the lead by virtue of their geographical advantages, followed by the central region. However, the development of the western region is relatively backward due to the comprehensive influence of geographical factors and other factors. The imbalance of regional development often brings many problems, the most important is the brain drain in the central and western regions, especially the lack of innovative talents. Innovative talents are one of the necessary conditions for the development of intelligent manufacturing technology. The lack of talents will lead to the lag of technology development, and then form a vicious circle of development in the western region.

4.3 Possible Strategies

4.3.1 Refinement

With the continuous improvement of people's living standards, people's needs are constantly changing, and they are paying more and more attention to the performance and quality of products, while they are paying more and more attention to experiential comfort. In recent years, the emergence of the profession of purchasing on behalf of others fully illustrates this problem. A group of customers in China have begun to flow abroad, so if we want to retain consumers, we must put forward some suggestions High manufacturing technology to provide a better user experience; in addition, medical devices, aerospace, railway transportation equipment, etc ^[12]. all need absolutely mature manufacturing technology, which requires very strict precision of products and technologies. However, China's original high-end equipment is now in an absolute disadvantage, the main reason is that the level of technology refinement and production autonomy can not reach the world-class level. And these areas can best reflect the status of the country, which is also related to the lifeblood of the country. So we must master its core technology. The more precise the technology is, the more core it is, the more difficult it is to imitate and surpass it. For example, China's high-speed rail manufacturing technology is recognized in the world, which can be said to be one of China's core technologies. China still has a considerable say in the global high-speed rail manufacturing. With the further development of intelligence, China's micro and nano technologies have gradually developed and matured, and blockchain technology has also developed maturely in China. The application of blockchain is bound to bring broad prospects to the development of high-end equipment in China ^[13], which has laid a solid foundation for the development of Intelligent Manufacturing Technology to refinement. The lack of core technology is an important reason for China's backward intelligent manufacturing technology ^[14]. As mentioned above, due to the lack of core technology, most of China's high-end equipment depends on imports, and has no say in the international vertical division of labor, only in the low-end labor-intensive production link. China's manufacturing technology in the middle and low-end link is still in a relatively leading level. In terms of high-end manufacturing technology, China lags behind other countries in precision. So if we want to have the core technology, our country's intelligent manufacturing technology must work hard on the automation and precision of technology. Then the national government should give some policy support and guidance. Innovation is the source of technological development. We should encourage industry university research cooperation in R & D innovation, and formulate innovation income risk protection policies, so that researchers can play to innovation without worries. At the same time, in order to narrow the gap between the central and western regions and the eastern and coastal regions and increase the introduction of talents to the western region, a series of preferential policies are established to encourage talents to develop in the western region. In addition, many high-end equipment in the western region are very scarce, so we can increase the investment of R & D funds in the western region and introduce some advanced high-end equipment. In the critical period of industrial transformation, a large number of traditional manufacturing needs correct guidance. Making relevant policies to classify manufacturing industry in detail can play a guiding role, of course, the policies should be updated timely with the development of the industry; secondly, training advanced managers. Transfer a group of scholars to study advanced management experience in foreign countries, and then to the domestic manufacturing industry to carry out knowledge transfer and talent training. On the basis of simulation, implement innovation suitable for China's national conditions, and cultivate managers with advanced management experience suitable for China. Managers can also go down to the grass-roots level to feel the change of technology in the production chain, and appropriately change the inherent management mode according to the advanced technology, so that the management experience closely follows the development of technology.

4.3.2 Networking

Since the Internet technology entered China, China's Internet economy has developed rapidly. The Internet has penetrated into people's life, study and work, and the development of the Internet has

also made "global village" a reality. At present, the Internet is more and more used in industrial production, making the purchase of raw materials and the sale of products networked. The network can In order to share computer resources, storage resources, data resources, information resources, knowledge resources and expert resources in a comprehensive and real-time way, networking not only improves the level of national resources, but also facilitates people's lives. Resource sharing is the most important advantage of networking, which integrates learning resources at different time and place, so as to timely update technology according to changes in the market The intelligent goal proposed by the United States and Germany fully reflects the future development trend of the manufacturing industry. The networking of technology will let part of the machinery replace the labor, and the operation of the equipment is often more detailed and accurate than the labor, so the technology will be improved. Network has been gradually applied to intelligent manufacturing. Network is the only way for the development of intelligent manufacturing technology in China.

4.3.3 Greening

With the rapid development of global industry, the shortage of resources and the pollution of environment are coming. With the increase of population, the cultivated land that can provide food is decreasing day by day. However, the industrial urban construction project is occupying a lot of cultivated land constantly. The use of chemical fertilizer and pesticide also makes the quality of cultivated land decrease constantly. All of these make people face the dilemma of insufficient cultivated land. The consumption rate of mineral resources is rapidly increasing with the speed of industrial construction, and the reserves of many minerals have been rapidly reduced in recent decades. Experts predict that 80% of the oil reserves will be consumed in another 50-60 years, and some precious metal resources are nearly exhausted. For the future of human beings, it is the common goal of people all over the world to advocate green sustainable development. The green manufacturing technology will maximize the waste of raw materials; at the same time, it will reduce waste emissions and environmental pollution. Reasonable construction of intelligent manufacturing ecosystem and construction of green industry. "Jinshan and Yinshan are not as green as ours.". Resources and environmental protection are eternal topics. After a long time of environmental pollution and resource demand, our earth has become vulnerable. Resource shortage is a global problem. In the future development, resource will be a major factor limiting the development of manufacturing industry. So it is also necessary for manufacturing industry to transform to green and environmental protection.

5. Summary

From the perspective of the model, the development of global intelligent manufacturing technology shows a more obvious stage distribution, and in a large scale, it has not really entered the stage of specialization, but the speed of development is very different. The development of intelligent manufacturing technology in China is in the front, but it is very backward compared with the United States and other countries. Therefore, it will take a certain time for the intelligent manufacturing technology of our country to achieve stable and long-term development. As a country with a large population, China's national conditions are quite complex. To find the way of intelligent development with Chinese characteristics, more practitioners and theoretical scholars are still needed to explore and explore. In recent years, in order to improve national competitiveness and international status, China's industrial focus has gradually shifted to intelligent manufacturing technology, and the development of intelligent manufacturing technology is the primary problem in China. Although China's industry started late and its development was limited by many historical problems, the country is taking measures to deal with a series of development problems. In order to better learn and absorb foreign advanced technology, and at the same time to stimulate innovation and open up the market [15], to build an international R & D network, a major trend of China's scientific and technological R & D, developed countries will block their own intelligent manufacturing technology and knowledge to some extent, and Chinese enterprises will cooperate with foreign schools, enterprises and other scientific research institutions to reduce this technology as much as possible And

knowledge gaps. In terms of the current situation of China's development, the development of intelligent manufacturing technology is still optimistic. Generally speaking, the development trend of intelligent manufacturing technology in China is quite rapid^[16].

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