Research on the Application Status of Artificial Intelligence in Equipment Manufacturing Industry

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Abstract: The application of artificial intelligence in equipment manufacturing industry is the inevitable result of the development of science and technology. It is imperative to promote the upgrading and transformation of China's equipment manufacturing industry by taking intelligent manufacturing as the focal point. This paper analyzes the penetration and integration of artificial intelligence technology in the equipment manufacturing industry. The existing problems and solutions are pointed out.

1. Introduction

The manufacturing industry is the main body of the national economy, the foundation of the country and the instrument of rejuvenating the country. In 2015, the State Council's Notice on the Publication of "Made in China 2025" pointed out that smart manufacturing is a new direction for the development of contemporary manufacturing industries. Academician Libohu of the Chinese Academy of Engineering also stated at the 2018 Annual Meeting of the Intelligent Manufacturing 100 that "Internet + Artificial Intelligence + Big Data +" is an inevitable result of manufacturing development. The innovation and deep integration of the new generation of artificial intelligence information technology and equipment manufacturing based on digitization, intellectualization, informatization and networking are triggering far-reaching manufacturing industry changes.

2. The Connotation Of Intelligent Manufacturing

The so-called "smart manufacturing" is based on a new generation of information technologies such as the Internet of Things, cloud computing, and big data, and runs through all aspects of manufacturing activities such as design, production, management, and services. The general term for advanced manufacturing processes, systems, and modes with information depth self-perception, intelligent optimization self-decision making, and precision control self-execution. It is the mutual penetration and in-depth integration of virtual networks and production processes. It is the result of "Internet + industry".

The application of artificial intelligence to the equipment manufacturing industry can use machine vision technology to provide information on the status of product parts, use large data analysis results to optimize the production process, and achieve real-time feedback in the equipment manufacturing process, thus realizing long-range monitoring and self-diagnosis and self-adjustment, and improving the self-adaptability of the production process. We will reduce labor costs and improve intelligence in equipment manufacturing.

The application of artificial intelligence in manufacturing has three main aspects: the first is intelligent equipment, including automatic identification equipment, human-machine interaction systems, industrial robots, and numerical control machine tools. The next is the smart factory, which includes intelligent design, intelligent production, intelligent management, and integrated optimization. Finally, intelligent services, including mass customization, remote transportation, and predictive maintenance and other specific service modes. Although the current artificial intelligence solution can not fully meet the needs of the manufacturing industry, as a universal technology, the

integration of artificial intelligence and manufacturing is the general trend.

3. Infiltration of Artificial Intelligence into Equipment Manufacturing Industry

3.1 From an Enterprise Perspective.

Artificial intelligence technology can integrate high-tech information technology with various processes such as design, production, management and services in the manufacturing industry. For example, "Weichai Power" company uses the industrial Internet to achieve the connectivity of equipment, production lines and products, and establishes a global resource allocation information support platform; The Beijing "Heli Time" establishes intelligent control system platform at installation level, workshop level and factory level, and realizes intelligent manufacturing process control and information security protection. Artificial intelligence is affecting and infiltrating every link of the equipment manufacturing industry, and has achieved certain results.(Tab.1)

Table 1 Some achievements of the penetration of artificial intelligence into the equipment manufacturing industry

Name	Main Content
Automobile engine flexible automatic assembly line	Realized the information highly integrated production continuous time stable nobody or few people operation, automatically according to the order arrangement to guide the production, and link to the automation control system
Start the stamping manufacturing digital workshop project	The intelligent monitoring system logistics transmission and information management system for automatic stamping parts of large auto cover parts
Annual output of 240,000 passenger car robot welding automation production line	It realizes the intelligent identification of any order mixed flow production and production model of six models of siping platform, The whole production process has realized digital control and remote control
Intelligent industrial robot welding automation production line	China's first intelligent industrial robot welding automation production line with completely independent intellectual property rights has been put into operation

Source: Department of equipment industry.

However, from the overall situation, only a few large equipment manufacturing enterprises in China have entered the stage of intelligent production, and some large and medium-sized enterprises are in the 3.0 stage of automation and informatization. Most equipment manufacturers are still in the 2.0 stage of production using pipelines and electric power, and on the whole they present a "upright Pyramid".

3.2 Regional Developments.

In Fujian, Shanghai, Shenzhen, Sichuan, Shandong and many other places, combined with their own characteristic industrial bases, have issued policy documents on smart manufacturing to promote the development of the equipment manufacturing industry, improving the intelligence level of the equipment manufacturing industry in the region and the entire manufacturing industry. For example, Qingdao, Shandong Province, took the lead in launching an action plan for the development of the Internet industry in 2015, successfully hosting the first World Conference on the Internet Industry, and actively guiding traditional manufacturing enterprises to implement the transformation of the Internet and smart manufacturing. It has successively trained a number of smart manufacturing models such as Haier Smart Interconnection Factory, Race Wheel Tire Digital Workshop, Desson Machinery Automation Production Line, and a number of smart equipment and solution providers such as Softcontrol, Hainer Heavy Industries, and Baojia Automation. It has created a number of Internet industrial platforms such as Haier's "Hai Chuanghui", the red collar

"Kute Intelligence", the rubber Valley "People's Research Network", and the "3D Yunzhi Construction" of Sandi Space and Time Space.

However, the different technologies, manpower, energy and other resources in different regions and the different levels of informatization in the equipment manufacturing industry have led to large differences in the level of intelligent manufacturing in the inter-regional equipment manufacturing industry. According to Zhixue Dong and Yingji Liu(2016), based on the factor analysis method, the comprehensive evaluation and empirical study of the intelligent manufacturing capabilities of major provinces and cities in China can be seen that the intelligent manufacturing levels in the equipment manufacturing industry in various regions vary greatly.
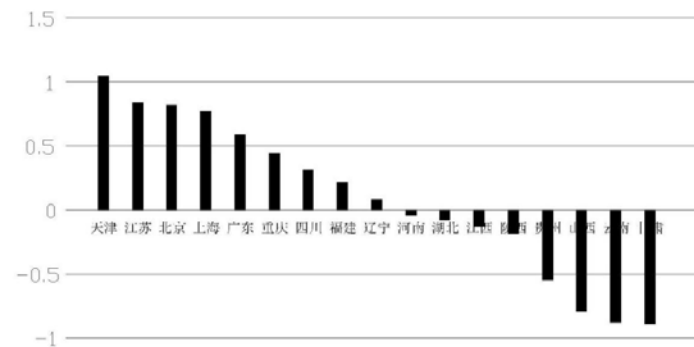

Fig. 1 Comprehensive score of intelligent manufacturing level in some provinces and cities□

4. Problems in the Integration of Artificial Intelligence into Equipment Manufacturing

Although the current integration of artificial intelligence and manufacturing industry has shown some results, but from the perspective of China's regional and enterprise level, there are still some problems in the process of intelligent manufacturing, worthy of attention.

4.1 Weak Basic Conditions for Intelligence and Insufficient Professional and Technical Personnel.

At present, 90% of our manufacturing enterprises have not completed the digital transformation, and the enterprise's information system and industrial system are still in a state of separation, or the degree of integration is far from meeting the requirements, which has brought great troubles to the intelligent manufacturing transformation. The 2016 China Statistical Yearbook shows that in 2015, the number of computers used per 100 people in the entire manufacturing industry was 19, and the proportion of enterprises with electronic trading activities was 10.2 %. From the perspective of enterprise informatization in the entire manufacturing industry, it is still at a low level.

The "Guidelines for Manufacturing Talent Development Planning" forecasts the demand for talents in the top ten key areas of "Made in China 2025" manufacturing industry. At this stage, the total gap in skilled personnel is as high as 30 million. According to the "13th Five-Year Plan for Mechanic Education", as of the end of the "Twelfth Five-Year Plan" period, there were 2,545 technical colleges and 434 technical colleges in China, with an annual enrollment of 1.21 million, and the proportion of students above the senior class was only 34.2 %. The above data show that the gap between the supply and demand of skilled personnel in the market in the future may continue to expand, and applied talents in the fields of robot applications, machine vision applications, and artificial intelligence will become the largest gap.

4.2 Low Capacity for Independent Innovation and Low Investment in Research and Development.

Independent innovation is the decisive factor of intelligent manufacturing in equipment manufacturing industry. However, some of China's manufacturing equipment is still at a relatively

weak level of independent innovation. High-end equipment, key components and parts are imported, and are controlled by others in integrated circuits, high-end software and intelligent sensing. Lack of key common technologies to guide and support the future development of intelligent manufacturing in China.

According to the statistics of the National science and technology expenditure in the past five years, the research and experimental development of China's equipment manufacturing industry(R&D) Funding has shown a clear upward trend since 2015, with an investment of 672.57 billion Yuan in 2017, with an investment intensity of 1.65%, an increase of 0.14 percentage points over the previous year. However, the intensity of R&D investment is still far from the level of 3%-4% in developed countries.
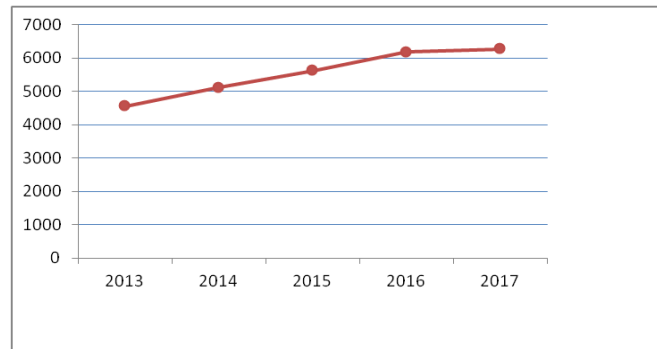

Fig. 2 Investment of R&D funds in equipment manufacturing industry from 2013 to 2017 (unit: 100 million yuan)

4.3 Imperfect Service System for Intelligent Manufacturing Promotion.

During the implementation of intelligent equipment manufacturing, intelligent process design, intelligent monitoring technology, and intelligent information integration management software all need the support of relevant modern service industries. But the domestic in the advanced production service industry added value and the level of technology, and industrial developed countries still have a certain gap. The market of intelligent manufacturing service industry is not fully opened, the relevant policy system is not perfect enough, and the degree of marketization is low; The traditional service industry accounts for too much, there is oversupply, and the proportion of advanced productive service industry is too small, and there is a serious shortage of supply. The development of intelligent manufacturing professional personnel training service system is lagging behind, and there is a shortage of talents in related advanced manufacturing service industries, which can not meet the needs of intelligent manufacturing technical personnel.

4.4 High Cost of Investment in the Early Stages and High Pressure on Enterprises.

The upgrading of the equipment manufacturing industry with smart manufacturing is a new and fundamental change. In the early stages, it is necessary to purchase smart manufacturing technology, install smart equipment, build networked and intelligent manufacturing systems, hire smart manufacturing talents, and train and study staff. Therefore, the cost consumption in the early stages is very large, and the cost pressure is relatively large for most companies. In addition, China's manufacturing industry has significant regional aggregation characteristics, and traditional industries with low industrial added value account for the majority, and low-cost business strategies are more prevalent. The result is that the enthusiasm of enterprises to invest in intelligent infrastructure is not high.

5. Suggestions for Promoting Smart Manufacturing

5.1 Strengthening Infrastructure Development and Attaching Importance to Personnel Training.

We will focus on training technology entrepreneurs and complex talents who are integrated with

Internet thinking and the laws of the real economy. We will implement a training plan for leaders in the Internet economy. Take a variety of methods such as team introduction, core talents, etc. to introduce leaders and complex talents such as Internet science technology leaders; We will explore the establishment of professional incubators to provide venture capital services for people with Internet technology and creative skills. We will establish a mechanism for colleges and institutions to cooperate with enterprises and institutions in the training of applied talents, support the establishment of practical training bases that integrate the Internet with the real industry, and combine production, research and research, and encourage universities and enterprises to jointly develop standardized personnel training.

5.2 Increasing Investment in Scientific Research and Breaking through Key Technologies.

The weak innovation capability of the equipment manufacturing industry in China is mainly due to the low investment in R&D talents, R&D funds, scientific research and research, and fixed assets in the technical service industry. It should be promoted mainly by increasing the number of R&D institutions, talents and investment in R&D funds. We will make use of pilot and demonstration enterprises to lead the way, gather the advantages of production, research and research in the industry, and jointly promote the integration and innovation of key technology equipment, software, and smart manufacturing equipment. We will make breakthroughs in the manufacturing of core basic parts and components, systems integration technology, and key smart technologies, vigorously promote the hatching of scientific and technological achievements, the testing of products, and the industrialized application of such technologies, and build capacity to support key core technological systems for smart manufacturing.

5.3 Strengthening Demonstration and Extension, and Building a Service System for Extension and Application.

We will establish and support a number of smart manufacturing service platforms and organizations such as technology research and development, product inspection and testing. We will develop a number of public services such as information consulting and technical evaluation. We will vigorously develop a number of industrial engineering companies and system integrators that provide services for the promotion of smart manufacturing models. Guide industrial design organizations with conditions to expand into the field of intelligent manufacturing. We will organize demonstration projects for smart factories in key industries. We will organize and implement pilot demonstration projects for smart manufacturing. At the same time, we will establish a training and training service system for advanced innovative talents, formulate policies to encourage the training of relevant talents, and ensure the transportation of professional talents in advanced manufacturing and service industries.

5.4 Strengthening Policy Support to Reduce Cost Pressure.

In order to "reduce the burden" of manufacturing enterprises, local governments can take the following measures: increase support for key enterprises; Increase market support to provide appropriate subsidies and tax incentives to local enterprises purchasing or leasing smart equipment manufactured in the province; We will increase financial support, attract social capital, and jointly set up a smart equipment industry development fund. We will accelerate the integration of scientific, technological and innovation resources with industrial and financial capital, and establish a financial service system that covers the entire process of the industrial chain of smart equipment innovation, including seed funds, angel funds, venture capital, guaranteed funds, and government venture capital guidance funds.

6. Summary

At present, China's equipment manufacturing industry is at a critical stage of transformation and upgrading and the transformation of old and new kinetic energy. We should move forward simultaneously in four areas: enhancing independent innovation capabilities, vigorously developing

smart manufacturing services, strengthening capital and personnel support and policy support, and making efforts to transform China's equipment manufacturing industry into high-end equipment, smart manufacturing and network manufacturing.

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