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On the Intelligent Manufacturing

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Abstract: *With the German "Industry 4.0" strategy and the American industrial internet technology, as well as the "Made in China 2025" plan proposed by China, countries around the world are paying more and more attention to the transformation and development of a new round of manufacturing industries. Intelligent manufacturing is bound to trigger a new industrial revolution and make a huge leap in manufacturing. Intelligent manufacturing is a manufacturing technology that conforms to the new development situation of the manufacturing industry, and it is also one of the important development strategies for countries to strive to become a manufacturing power. This article starts with the development process of the manufacturing industry, briefly introduces the historical development stage of the manufacturing industry and the current situation of intelligent manufacturing, and further analyzes the future of intelligent manufacturing.*

Keywords: *Intelligent Manufacturing, Intelligent, Manufacturing*

1. Introduction

Throughout the development history of human production and manufacturing, it is not difficult to see that high efficiency, high quality, and liberation of human hands have always been the goals that people pursue. From manual labor production to the mechanized mass production of the industrial revolution, to the automated production line produced by the development of information and electronic technology, these are all the production processes that people gradually improve social productivity and pursue excellence and efficiency. Therefore, intelligent manufacturing is an inevitable choice to greatly liberate human labor and improve social productivity. At the same time, the problem of the aging of the world's population has become increasingly prominent, especially in developed countries with relatively small populations. How to rely less on people in the production process is an urgent problem to be solved. Also worthy of attention are the serious problems facing energy and the environment. Green manufacturing has been put forward and valued by people. More reasonable and efficient use of resources and reduction of pollutant emissions are urgent development requirements. Intelligent manufacturing should also be a green manufacturing method, which cannot be sacrificed at the expense of the environment, otherwise it is a retrogressive production method. Based on the above main factors, intelligent manufacturing is an important development direction for developing countries to realize the transition from labor-intensive industries to technology-intensive industries, and it is also an important trend for the development of manufacturing industries in developed countries in the future.

2. Manufacturing History

The development history of the manufacturing industry can be traced back to the time when people began to use stone tools in ancient times. With the advent of bronze and iron tools, people's ability to use production tools became stronger and stronger, and thus the productivity of transforming nature became stronger and stronger. As far as the development process of modern manufacturing is concerned, it has roughly experienced the following three stages [1].

The first stage of the development of the modern manufacturing industry started in the 1860s of last century, with mechanized mass production mainly powered by steam. Although the product varieties during this period were relatively single and the craftsmanship was relatively backward, compared with the handicraft era, it still greatly improved social productivity. People began to manufacture large mechanical products such as steam trains and steam ships. These have accumulated a lot of practical experience for the improvement of the later manufacturing process and production mode.

In the mid-19th century, modern manufacturing began to enter the era of electrification. The rapid

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development of power electronics technology has promoted the rapid improvement of the manufacturing industry in two aspects. On the one hand, electric power technology has solved the energy problem and provided greater energy power for the production and manufacturing process; on the other hand, the rise of electronic technology has made the manufacturing process automated. During this period, the types of products began to gradually form standardization and serialization, which led to the rapid development of traditional manufacturing.

The modern manufacturing industry entered the third stage in the 1970s, accompanied by the advent of the information age. Internet technology and digital technology have turned the world into a global village, and the ties between countries in the world are getting closer. The intercommunication and exchange of information means that the manufacturing industry is not restricted by regions. The world has entered a "collaborative manufacturing" environment, and the scale of the manufacturing industry continues to expand. In this period, the management concept of the manufacturing industry has been greatly improved. Numerical control technology has further improved the automation of the manufacturing industry. Digital design and analysis technologies have also begun to be used in product manufacturing engineering, effectively improving product quality and reliability.

3. Introduction and Status quo of Intelligent Manufacturing

As the global product market demand presents a personalized and diversified development trend, the manufacturing industry needs to adapt to the product market demand, analyze product characteristics through artificial intelligence technology, and use information technology and digital technology to make manufactured products an intelligent production process, namely realize intelligent manufacturing.

Intelligent manufacturing is a general term for intelligent manufacturing process and intelligent manufacturing system integration that runs through the entire life cycle of products in the product manufacturing neighborhood based on information technology, digital technology and artificial intelligence technology. It has the characteristics of information self-perception, intelligent self-decision, precise self-control and execution [2]. All activities of the intelligent manufacturing system are driven by external and internal information. The processes from product design and development to manufacturing and later service management are all digital, automated, and intelligent. The product manufacturing process no longer relies on human judgment, decision-making and operation, which greatly improves production efficiency, reduces operating costs, and most importantly improves product quality. The dynamic information management and control of the whole process of product design, manufacturing and service is convenient for enterprises to manage and monitor product quality and production progress, while also providing better customized services for customer needs.

Intelligent manufacturing is also a human-machine integrated intelligent system composed of intelligent machines and human experts. It can perform intelligent activities in the manufacturing process, such as analysis, reasoning, judgment, conception, and decision-making. Intelligent manufacturing expands, extends and partially replaces human mental labor in the manufacturing process through the cooperation of humans and intelligent machines. It can greatly improve production efficiency, production capacity and save resources. It is an important direction for the transformation of human production methods [3].

In developed countries, due to the relatively mature industrial manufacturing foundation and advanced manufacturing technology, the information manufacturing industry has developed more maturely. Intelligent manufacturing is the main development and transformation model that developed countries will face in the future. At present, the manufacturing industry in developing countries is still in a state of coexistence of traditional mechanization, electrical automation, and informatization, and the degree of development in each stage is uneven. In some countries with a backward industrial base, due to backward technology, the manufacturing industry has been in the transition stage from traditional mechanization to electrical automation, resulting in the failure of rapid development and widespread application of advanced industrial manufacturing technologies. In some developing countries, although the manufacturing industry has achieved electrical automation, intelligent manufacturing based on information technology and artificial intelligence technology requires the support of operating systems and basic digital technologies, and the level of technology in these areas is still low in these developing countries. These technologies need to be improved.

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4. The Future Development of Intelligent Manufacturing

The world economy is undergoing a new round of industrial transformation, and intelligent manufacturing will surely play a key role in the transformation of the manufacturing industry. For developed countries, relying on mature and advanced manufacturing technology to realize the intelligent production of the entire industry is its ambitious development goal. At the same time, developed countries must further improve the level of intelligent technology innovation. Intelligent technology innovation is a key factor in the development of intelligent manufacturing.

For developing countries, gradually improving the level of electrical automation and informatization production and improving the industrial manufacturing system is a necessary prerequisite for the development of intelligent manufacturing. At the same time, it is necessary to improve the level of information technology and digital network technology, pay attention to the training of talents related to intelligent manufacturing, and gradually carry out the transformation of intelligent manufacturing from small and medium-sized industries [4]. In addition, according to the development level of its own manufacturing industry, the influencing factors of the intelligent transformation and upgrading of the manufacturing industry must be thoroughly analyzed, and the development path and mode of intelligent manufacturing must be studied systematically [5].

Of course, the industrial construction of intelligent manufacturing is not limited to the above-mentioned aspects. Because there is still a certain unbalanced development in the technological level of the manufacturing industry between different industries, only under the premise of the improvement of the basic industrial technology level and the accumulation of experience, and the theoretical innovation and technical reserves should be emphasized. The process of the intelligent manufacturing industry can be steadily promoted, it will achieve ultimate success. Under the premise of backward process technology and information technology, it is inappropriate to quickly pursue the development path of intelligent manufacturing industry construction.

5. Conclusion

With the accelerating process of economic globalization, the manufacturing industry needs to transform from the traditional mechanization and automation mode in order to meet the needs of more diverse market products. With the rapid development of information technology and intelligent technology, the manufacturing industry is shifting to an intelligent production model. Both developed and developing countries should recognize the level of development of their own manufacturing industry, based on mature industrial manufacturing technology and intelligent technological innovation, in order to achieve success in this manufacturing transformation.

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