

Comparative Research on Germany "Industrie 4.0" and "Made in China 2025"

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Abstract. Germany proposed intelligent manufacturing-led "Industrie 4.0", designed to keep the manufacturing powerhouse of the world; China also propose "Made in China 2025", aims to change manufacturing industry "big but not strong". Both of them belong to the transformation and upgrading of the manufacturing strategy, and include the digital, networked, intelligent as strategic support, strategic planning are similar, too. But they are different in national history, manufacturing foundations and strategies vary. Overall, the "Industrie 4.0" has a reference significance to realize "Made in China 2025".

1. Introduction

Manufacturing has been one of the important indicators of a country's comprehensive strength since the beginning of industrial civilization in the middle of the 18th century. So far, the history of mankind has experienced three Industrial Revolution: the invention and using of the steam engine triggered the first industrial revolution which has changed the mode of production of goods in the end of the 18th century; early 20th century, large-scale producers based on electrification is considered to be the second industrial revolution; since the 1970s, with IT technology and information-based third industrial revolution improved the level of automation of industrial production. This third industrial revolution has greatly promoted the development of the social productivity and changed the world economic landscape.

After entering the era of crisis, the rapid progress of science and technology, especially advances in artificial intelligence, robotics, and digital manufacturing technology, has changed the original layout of manufacturing. Developed countries have put forward their own national industrial strategy, trying to take the opportunity to return to dominance in manufacturing. "Industrie 4.0" which is proposed by Germany is an intelligent manufacturing-led, designed to keep the manufacturing powerhouse of the world. Developing countries hoping to development, and restructuring the manufacturing sector to enhance the competitiveness of manufacturing industry in the global. "Made in China 2025" is one of that.

2. What's the Germany "Industrie 4.0" and "Made in China 2025"?

2.1 Germany "Industrie 4.0"

In April 2011, Hannover Industrial Fair in Germany put forward the concept of "industrial 4.0" for the first time. In April 2013, in a published report German manufacturing in the future: Suggestions for implementing the strategy of "Industrie 4.0", marked the forming of Germany "Industrie 4.0". "Industrie 4.0" has risen as the national strategy of Germany currently. Industrie 4.0, which also can be called Industry 4.0 or the fourth industrial revolution[1], is a collective term embracing a number of contemporary automation, data exchange and manufacturing technologies. It had been defined as 'a collective term for technologies and concepts of value chain organization' which draws together Cyber-Physical Systems, the Internet of Things and the Internet of Services.

There are four design principles in Industry 4.0. These principles support companies in identifying and implementing Industry 4.0 scenarios[2].

Interoperability: The ability of machines, devices, sensors, and people to connect and communicate with each other via the Internet of Things (IoT) or the Internet of People (IoP).

Information transparency: The ability of information systems to create a virtual copy of the physical world by enriching digital plant models with sensor data. This requires the aggregation of raw sensor data to higher-value context information.

Technical assistance: First, the ability of assistance systems to support humans by aggregating and visualizing information comprehensibly for making informed decisions and solving urgent problems on short notice. Second, the ability of cyber physical systems to physically support humans by conducting a range of tasks that are unpleasant, too exhausting, or unsafe for their human co-workers.

Decentralized decisions: The ability of cyber physical systems to make decisions on their own and to perform their tasks as autonomous as possible. Only in case of exceptions, interferences, or conflicting goals, tasks are delegated to a higher level.

Characteristic for industrial production in an Industry 4.0 environment are the strong customization of products under the conditions of highly flexibilized (mass-) production. The required automation technology is improved by the introduction of methods of self-optimization, self-configuration, self-diagnosis, cognition and intelligent support of workers in their increasingly complex work. German industrial 4.0 "is essentially the mechanization, automation and information technology as the foundation, to set up the new production mode of intelligence and industry organizations.

2.2 China "Made in China 2025"

On May 19, 2015, State council issued the "Made in China2025"[3], the deployment of the all-round implementation of manufacturing strategy, which is divided into four parts: analysis on the situation and background, basic guiding principles, strategic task and the key areas of development, as well as the support and guarantee system.

Specific content as follows:

Four transformation: 1 driven by factors shift to innovation; 2 by the low cost competitive advantage to quality benefit competitive advantage; 3 by a large resource consumption and pollutant emission more extensive manufacturing to green manufacturing; 4 from the production manufacturing to service-oriented manufacturing.

A common thread: The "made in China 2025" reflect depth integration of digital information technology and manufacturing technology as the main line of intelligent manufacturing.

Eight countermeasures: Eight policies include: intelligent digital networked manufacturing; Improve product design ability; Improve the manufacturing technology innovation system; Improved manufacturing base; Improve product quality. Implementation of green manufacturing; Develop globally competitive enterprise groups and the superiority industry; The development of modern manufacturing services.

"China 2025" strategy is to promote the transformation and upgrading of the manufacturing industry driven by innovation, promote global manufacturing value chain from low-end to high-end, from resource-dependent, type of environmental damage, labor and capital-intensive traditional manufacturing industry paradigm shift to a resource-saving and environment-friendly, sustainable development model innovation-driven [4].

3. Comparative Analysis

"Industrie 4.0" and "made in China 2025" all belongs to a national manufacturing industry development strategy, but their different in the national history, strategy implementation and the specific content of the strategic planning.

Table 1. Comparison of the German "Industry 4.0" and "Made in China 2025"

| | "Industrie 4.0" | made in China 2025 |
|------------------|---|---|
| time | 2013.04 | 2015.05 |
| sign | German manufacturing in the future: Suggestions for implementing the strategy of "Industrie 4.0 " | Made in China 2025 |
| background | Post Crisis Era | China's manufacturing big but not strong |
| aim | To improve the competitiveness of manufacturing industry in Germany | To promote from manufacturer to make power |
| essence | re-industrialization strategy | transformation and upgrading of manufacturing strategy |
| Primary coverage | "1core", "2 strategy", "3 integration" and "8 measures" | 1 emphasize innovation drive, 2 quality first, 3 green development, 4 structure optimization, 5 people oriented |

3.1 National history

Germany is the European and global manufacturing developed economies, also is the world's third, Europe's first big commodity exporters, particularly automotive, chemical, electronic and mechanical products enjoy high reputation. Even in across the eu's debt crisis, with Germany's economy is still manufactured exports can "stand out" in Europe.

In 2012, the added value of China's manufacturing industry is \$2.08 trillion, in the global manufacturing sector accounted for about 20%, become the world's manufacturing power. But China's manufacturing big but not strong, embodied in: the low innovation ability, Industrial agglomeration and clustering development level is low; Product quality problems; Low resource utilization efficiency.

German manufacturing industry has been strong competitiveness in the world, through the implementation of the "industrie 4.0", to maintain the leading position in manufacturing continue to lead the development of the global manufacturing; While China's manufacturing industry is in a state of "big but not strong", manufacturing extensive development mode is not sustainable, and rely on the traditional advantage of low cost of demographic dividend in China is abate, in this case, the "made in China 2025" want to be able to borrow dongfeng "industrialization", to improve manufacturing industry.

3.2 Strategy implementation

From the industrial development in the history of Germany has a powerful support to achieve the "4.0" industrial conditions. German manufacturing has experienced three times before the industrial revolution, "industrie 4.0 " is done in "industrie 1.0", "industrie 2.0" and "industrie 3.0" basically completed manufacturing is proposed on the basis of the development strategy of natural upgrade. China's manufacturing industry according to the late stage of development is still in the "2.0" industrial, put forward the "made in China 2025" is the transformation and upgrading of manufacturing the overall planning, promote the competitiveness of the manufacturing industry.

From the realistic condition analysis, German manufacturing into a service in the western developed countries dominated after later still occupies an important position in the industrial society, the real economy developed for "4.0" industrial advance power. China's education is behind that of Europe and the United States . Specific performance in terms of primary school enrollment while almost, but the school education of time and enormous gap of the achievements. In addition, our country also has the scientific research achievements conversion rate is low, the industrial generic technology research and development and industrialization of weakening theme, so technology based on the implementation of strategy of "made in China 2025" are far from Germany.

3.3 Strategic planning

Planning has been clear about the implementation of the "Industrie 4.0" strategy and the implementation steps, core, strategy, initiatives and support elements such as concrete, are high

feasibility, embodies just consistent with the characteristics of German's seriously, hard work. By the way, "Made in China 2025" is focused on the situation and the analysis of background, basic guiding principles, strategic task and the key development areas, as well as the support and guarantee system, embodies the Chinese government institutional reform as well as the characteristics of the government to organize and implement.

3.4 Similar trends

Germany "Industrie 4.0" and "Made in China 2025" purpose, although not completely the same, but under the global wave of "re-industry", for the direction of the new round of industrial revolution, Digitization, network, intelligence are the "4.0" mainly development trend, is also the transformation and upgrading of China's main fulcrum. Intelligent manufacturing as the leading "Industrie 4.0" will all kinds of resources, information, goods and people together, formation of many Internet information Physical System (Cyber - Physical System, the CPS). The Chinese government has put forward the action plan of "Internet + industry", in addition to using the Internet information and spread quickly, and will also be using the Internet to realize manufacturing without boundaries, the value chain upstream and downstream partners sharing economy universal. Our country accelerate informatization and industrialization depth fusion, increase the intensity of the traditional industry upgrading, inseparable from the "Industrie 4.0" and the integration of Internet development.

On the time dimension, the German expected to reach the "Industrie 4.0" basically in 10-15 years, it has same time dimension with the "Made in China 2025" planning phase.

4. Conclusion

Today, the world in a new round of industrial revolution, the ultimate power lies in a new round of technological revolution exponential growth of information technology and digital network and intelligent integrated innovation is to popularize and apply the three drivers of the industrial revolution. Although China's manufacturing industry foundation is weak, there is lack of innovation, cohesion is not strong, and low resource utilization of the problems, but in the face of the world must head-on straight on the tide of "industrialization", make greater efforts to shift to digital, networked, intelligent development.

Earlier Industrial Revolutions did not happen overnight, nor were they recognized as such at the time. For its part, Industrie 4.0 may or may not be recognized as revolutionary - rather than evolutionary - in retrospect. Yet it is a natural consequence of M2M communication further automating the factory floor, and like its predecessors it should result in more plentiful, lower cost products which is a net benefit for all concerned.

Whether revolution or evolution, industrial production is about to become a lot more efficient. Stay tuned for more exciting developments. Better yet, get involved in making them happen.

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