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Research on the Internationalization Development of China's High-Speed Rail

Jingwen Wang

Jiangxi Institute of Applied Science and Technology, Nanchang, Jiangxi, 330100, China

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Abstract: Under the environment of rapid development of international manufacturing industry, the transformation and upgrading of Chinese manufacturing and the rapid development of China's high-speed rail construction have created Chinese miracles, and at the same time, they have changed China and shocked the world with unprecedented depth and breadth. Especially at the beginning of this year, the total mileage reached 40,000 kilometers, which can circle the earth's equator once. China's high-speed rail should go global and develop internationally. Through SWOT analysis, the corresponding strategies of China's high-speed rail in the process of internationalization development and the goal of "eight verticals and eight horizontals" show the hard power of China's high-speed rail internationalization development and move towards internationalization.

1. Preface

Under the background of intensified international manufacturing competition and the brewing outbreak of a new round of industrial revolution, China's manufacturing industry is facing severe challenges. It is necessary to firmly grasp the current rare strategic opportunities, actively respond to challenges, strengthen overall planning, transform and upgrade from "manufacturing" to "intelligent manufacturing", and put forward "Made in China 2025", with intelligent manufacturing as the main direction. As China's manufacturing industry, China's high-speed rail has rapidly developed into a "four vertical and four horizontal" high-speed rail network pattern in recent years. The development plan of "eight vertical and eight horizontal" high-grid network pattern has enabled China's high-speed rail to achieve a qualitative leap, and its core construction technology, construction scale and construction quality have been recognized, demonstrating the hard power of China's high-speed rail [1]. It creates better development opportunities for going abroad and internationalization.

2. The Past and Present Situation of China's High-Speed Rail

2.1 The Former Life of China's High-Speed Rail Industry "Introduction Back Wardness Reintroduction"

The rapid development of high-speed rail in China is rare in the world, but the previous life of high-speed rail is the pain point of Chinese manufacturing industry. It will only introduce foreign

advanced science and technology, but can not carry out innovation, resulting in backward development, resulting in a vicious circle of re-introduction.

As we all know, there are only three core technologies of trains: traction system, bogie and braking system. The most important thing is the traction system, like "the heart of the train". Key technologies such as traction system account for 20%-30% of the total price of a motor train. Among them, the automatic train control system accounts for more than half of the whole traction system, with the highest profit. Siemens, Kawasaki and Alstom have not transferred this technology, just like the traction system, and the braking system, which is regarded as the foundation of survival by the foreign party, has not implemented technology transfer, but is produced by the foreign party's joint venture factory in China. "There is no technology transfer in the joint venture factory, and the Chinese side may not even see the drawings." The braking system of high-speed rail is monopolized by Knohl, and the core technology has not been transferred. Among the three major systems, bogie manufacturing has signed a technology transfer contract, which only sells installation drawings and does not talk about design principles. The Chinese side knows why.

A person involved in the introduction revealed that Siemens experts did not directly answer the reason why the bogie parameters were set in this way, but asked carelessly. Nowadays, the components of bogies are welded by long passengers, and the rest parts are bought abroad. An engineer from CSR Zhuzhou said metaphorically: "By buying EMUs from several foreign companies, we bought four fish, but we didn't buy fishing techniques and methods. The key components of the automatic control system had to be imported, and the source code of the control software was never transferred." [2] In the introduction of high-speed rail technology, China created and gave up a huge market, but it was foreign manufacturers who really earned high profits at the top of the pyramid. They took the initiative by controlling core technologies and key spare parts, which led to the backwardness of China's high-speed rail and were delayed and shelved, and the cost was too high to run!

2.2 The Present Life of China's High-Speed Rail "Digestion Absorption Recreation"

When China introduced EMU technology, it began to gradually transform into the initiative of it's own development and creation. First, it introduced Shinkansen in Japan, Alstom in France and Siemens in Germany. First, overcome the technical problems of Shinkansen in Japan and Alstom in France. In the first generation of models, CRH2C high-speed EMU began to innovate in an all-round way, and nine core technologies were fully mastered, all of which achieved independent conquest. Therefore, CRH380A, which inherited CRH2C technology in the second generation of models, easily passed the evaluation of the United States and has completely independent intellectual property rights. [3] CRH5 high-speed EMU has a low degree of technical autonomy in the initial stage, but it has overcome the most critical traction drive technology and network control system in the later stage, and has also realized technical autonomy. Relatively speaking, the imported German technology is relatively low in technology autonomy, mainly CRH3 high-speed EMUs in China, and the subsequent CRH380 high-speed EMU. Through independent development and continuous updating and iteration of products, we can get out of the road of complete sinicization.

2.3 China's High-Speed Rail Is Internationalized "Recognition Income Generation Re-promotion"

The rapid development of China's high-speed rail technology is not limited to the domestic market, but goes global. In October 2014, CRRC Changke won the bid for the Red Orange Line subway project in Boston, Massachusetts, USA, which was the first time that Chinese high-end equipment successfully entered the United States. Among them, in 2015, the number of vehicles exported by

CRRC's long-distance passenger products totaled more than 8,000, earning more than 8 billion US dollars, becoming the representative of China's high-speed rail going global [4]. In 2015, the Indonesian government selected China to build the first high-speed rail project in Indonesia-Yawan high-speed rail. In 2016, China and more than 30 countries including the United States, Russia, Australia, Brazil, Thailand, Saudi Arabia, Iran, Singapore, New Zealand, Argentina and Ethiopia negotiated high-speed rail projects. China's high-speed rail accounts for 73.04% of the market share in Asia, and its operating mileage accounts for 48.50% of the total operating mileage of high-speed rail in the world.

3. SWOT Analysis of Internationalization Development of China's High-Speed Railway

3.1 Strength

First, the national government strongly supports it. In recent years, the Chinese government has adopted the policy of "high-speed rail diplomacy" and vigorously promoted China's high-speed rail. In particular, when Premier Li Keqiang visited other countries, he actively publicized the technology and construction experience of China's high-speed rail, which made China's high-speed rail move towards the international market.

Second: the advantages of domestic operation and management of China's high-speed rail. Beijing Business Today reported on May 25, 2022 that by the end of 2021, the national railway mileage had exceeded 150,000 kilometers, including more than 40,000 kilometers of high-speed rail [5]. Figure 1: Statistics of China's railway operating mileage from 2011 to 2021 (the content is reproduced from the railway construction planning WeChat official account, and the statistics are not the official version.)

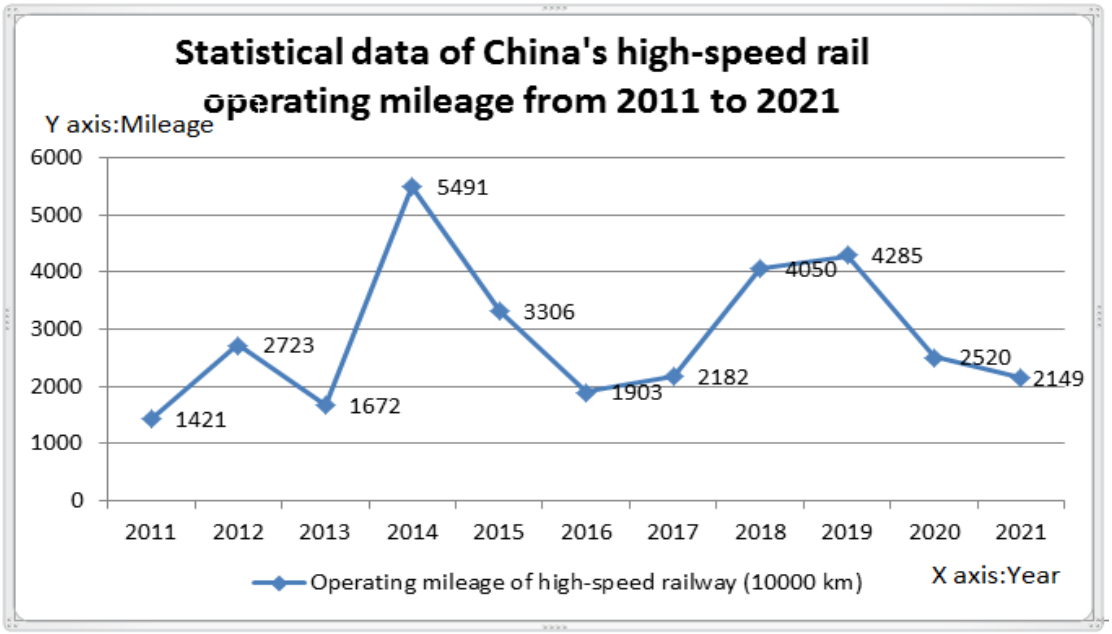

Figure 1: Statistics of China's railway operating mileage from 2011 to 2021

Figure 2 and Figure 3 shows that according to the data analysis of the National Bureau of Statistics, the output and growth of China's EMUs from 2015 to 2018. From the perspective of EMU output, by 2018, the output of China's EMUs was 2,724, with a growth rate of 0.05%. In 2018, China operated more than 4,500 bullet trains every day, ranking first in the world, with a year-on-year increase of 4.77%. More than 6 billion passengers have been sent. [6] Therefore, from the demand and output of China's EMU market, it can be seen that the development prospect of EMU is considerable, and it is

expected to participate in the international market competition, go out of China and rush to the world.

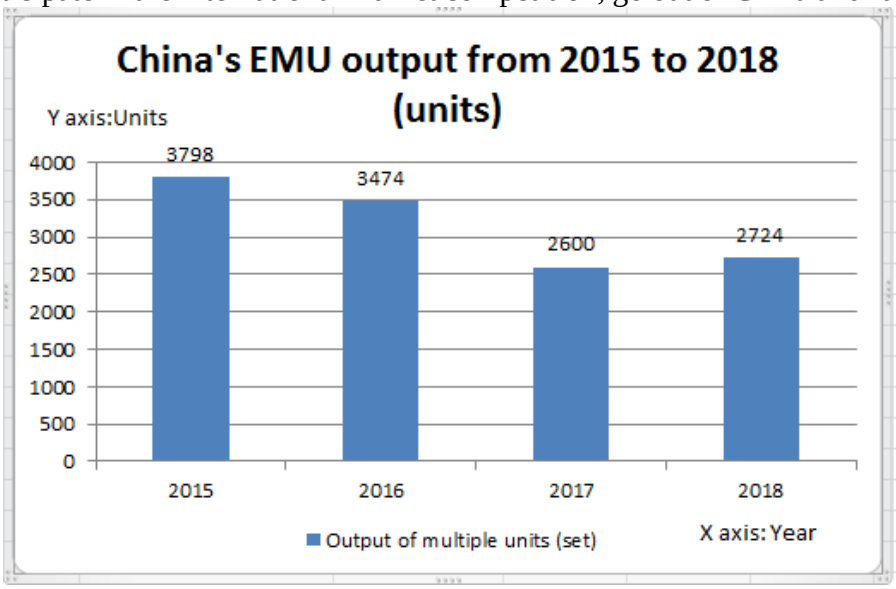

Figure 2: Source: Finished by National Bureau of Statistics and Huajing Industry Research Institute

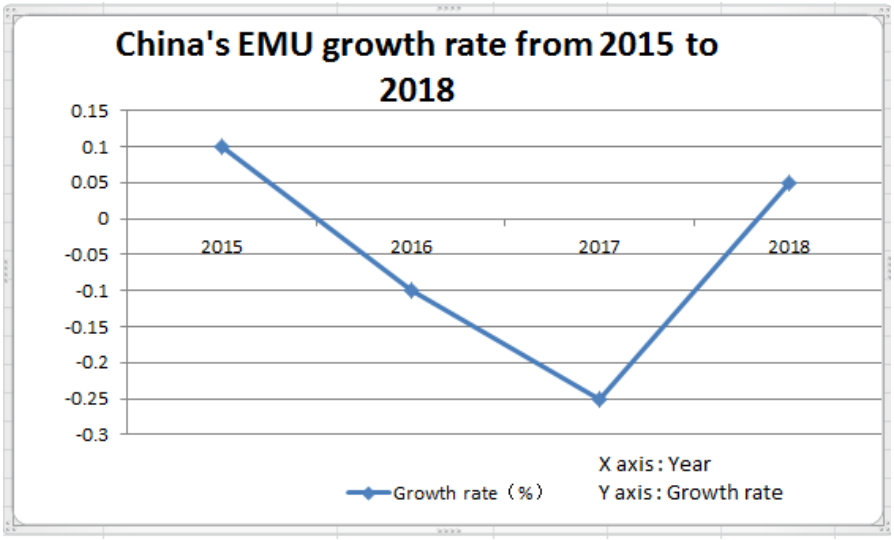

Figure 3: Source: Finished by National Bureau of Statistics and Huajing Industry Research Institute

In fact, in 2016, the number of high-speed rail passengers sent by China exceeded 1.47 billion, with an average of 4.03 million passengers traveling by high-speed rail every day. China's high-speed rail has influenced China in breadth and depth. For example, high-speed rail passengers order food online, and even new services such as robot inquiry, online service reservation and in-car Wi-Fi are continuously introduced, which greatly facilitates people's travel. The "four vertical and four horizontal" high-speed rail network has been basically completed, and it is the only country in the world where high-speed rail runs into a network. China's high-speed rail construction continues to advance rapidly, especially with the development of "eight vertical and eight horizontal" in recent years. China's high-speed rail has shocked the world and moved towards international development.

Third, China's high-speed rail industry has advantages in construction cost and economies of scale. The investment in high-speed rail construction is huge, which requires a lot of manpower, material resources and financial resources. China's high-speed rail has formed a complete industrial system in China, and only a few parts need to be purchased from abroad. According to the World Bank report,

the average construction cost of China's high-speed rail in 2014 was 350km/h, and the construction cost of high-speed rail was 129 million yuan/km; The construction cost of 250km/h high-speed rail is 87 million yuan/km. The average construction cost of high-speed rail in other countries exceeds 300 million yuan per kilometer, which is significantly higher than that in China.

Fourth, China's high-speed rail technology has obvious advantages. It has technical advantages in high-speed rail manufacturing, engineering construction and project management. China's high-speed railway embodies the scientific and technological resources of 6 large state-owned railway enterprises, 1 research institute, 25 universities, 51 state key laboratories and national engineering centers. In addition, China's high-speed rail actively participates in the research and development and exchange of world rail transit technology, and promotes the construction of world high-speed rail. [7] China and Germany signed a cooperation agreement to establish a "Sino-German Rail Transit Technology Joint R&D Center" to further promote the development of China's high-speed rail technology.

Fifth, the demand side under the international high-speed rail environment. In the next decade, nine European countries with high-speed rail will invest 200 billion US dollars to extend the current 7,000-kilometer railway to 160,000 kilometers; The United States will invest 53 billion US dollars in the short term, and it is expected to build six high-speed railways with a total length of 27,000 kilometers in the long run; Brazil plans to build a 510-kilometer Sao Paulo-Rio de Janeiro high-speed railway from 2018 to 2020, which is expected to cost 16.5 billion US dollars; The UK is preparing for the H S2 high-speed rail, which is planned to be completed from 2017 to 2026 and is expected to cost 51 billion US dollars; The Arab League plans to build 18 railways connecting 21 countries with a total length of about 33,000 kilometers. The estimated cost of this large order has not been estimated; India is expected to invest 54 billion US dollars to build a 1,754-kilometer Deli Qinnai high-speed rail project by 2020; Iran is expected to invest 13 billion US dollars to build the Qom-Isfahan high-speed rail project by 2030; ASEAN plans to build high-speed rail projects such as Pan-Asia, Singapore-Malaysia and Thailand from 2015 to 2030. [8]

3.2 Weakness

First, technical management talents are scarce and innovation ability is insufficient. High-speed rail products need large-scale infrastructure, large capital investment and high-skilled talents with R&D ability. Technological upgrading and innovation promote the establishment of international standards of China's high-speed rail technology. At the same time, talents who are proficient in the economy, culture and language of the host country should meet the market demand of the host country through technological improvement. Provide soft power support for the internationalization of China's high-speed rail. In terms of innovation, according to the 2017 Railway Statistics Annual Data of the Ministry of Railways of China, there are more than 8,000 patents applied by all railway rail transit manufacturers in the world, of which more than 1,000 are applied for patents in China. However, the number of patents applied by high-speed rail enterprises in China is less than 3%, and there is still a big gap compared with overseas giants.

Second: China's high-speed rail brand is not yet mature. In the world, the traditional high-speed rail giants developed earlier, accumulated rich experience and occupied a place in the world market. However, as China's high-speed rail developed later, its influence in the international market was limited, and it was difficult to shape the brand image in the international market.

3.3 Opportunities

First, the influence of the national development strategy opportunity of the "the belt and road initiative" cooperative development concept and initiative. In the past five years, more and more countries have responded, and China and countries along the "the belt and road initiative" have built

a bridge of cooperation for common development and prosperity. The pace of China's railways going out is also accelerating, and the two brands "Harmony" and "Fuxing" are famous all over the world. Today, the Anyi high-speed railway has been completed and opened to traffic. The signed projects include Indonesia high-speed railway and China-Laos railway. The construction of Hong Kong high-speed railway is progressing smoothly; It has been basically determined that the signing of the contract has not yet been completed, including the China-Laos Railway, the Russian Mocha High-speed Railway, the Hungarian Railway, and the Sino-Thai High-speed Railway; Singapore-Malaysia high-speed rail and California high-speed rail are striving for it. In addition, China Railway has taught its own experience and technology, trained hundreds of train drivers for countries along the "the belt and road initiative", and made the advanced technology and management concept of China's high-speed rail go global. Foreigners can't help but marvel and envy when they see China's high-speed rail, and even call it China's four new inventions. [9]

Second, under the opportunity of "Made in China 2025", which is proposed by China to transform and upgrade from "manufacturing" to "intellectual manufacturing", it provides the development of China's high-speed rail with "quality" instead of "quantity". Under the background of intensified international manufacturing competition and the brewing outbreak of a new round of industrial revolution, China's manufacturing industry is facing severe challenges. It is necessary to seize the rare strategic opportunities, actively respond to the challenges and strengthen overall planning. "Made in China 2025" takes intelligent manufacturing as its main direction, aiming at combining the existing information and automation technologies through the new generation of information technologies such as Internet of Things, cloud computing and big data, connecting all elements of the manufacturing system, forming a cyber-physical systems, and realizing mutual cooperation and echo from afar. Therefore, the production mode frame is transformed from resource-driven to information-driven, and the process of product manufacturing will reflect the value of intelligent manufacturing, including scientifically arranging production processes, improving productivity, etc., and can also adjust the use of resources and adopt the most energy-saving way.

Third, the National Development and Reform Commission, the Ministry of Transport and the State Railway Administration jointly issued the 13th Five-Year Plan for Railway Development. According to the Plan, by 2020, the national railway operating mileage will reach 150,000 kilometers, including 30,000 kilometers of high-speed railway, and the double-track rate and electrification rate will reach about 60% and 70% respectively, basically forming a railway network with reasonable layout, wide coverage, distinct levels, safety and high efficiency.

3.4 Treats

First, the political risks are great. The instability of the host country's state power and changeable policies are the main sources of political risks, which will lead to the failure or stranding of China's construction projects abroad and greatly hinder the internationalization of China's high-speed rail development.

Second, the threshold of international financing is too high. Chinese financiers typically offer foreign projects at rates no lower than 2%, while many Western countries can offer 0.5%, sometimes 0.1% or even no interest. In Indonesia's project, the loan interest rate provided by China is 2%, while the loan interest rate provided by Japan is 0.1%, which is very different.

Third, technical barriers to trade. In order to protect the interests of domestic enterprises, the import behavior of related products is restricted by formulating technical standards. Germany, France and other countries developed high-speed rail earlier than China, and developed more maturely in technology, management and operation, so European technical standards have great influence on a global scale. When China enters the international market, it must adopt European standards.

Fourthly, environmental factors, humanistic factors and legal and cultural differences in different countries will plague the internationalization of China's high-speed rail development. In order to improve the international competitiveness of China's high-speed rail, continuously improve the demand for international talents, and let China's high-speed rail show its talents in the world. Third, the research strategy of China's high-speed rail internationalization development.

4. Create a Favorable Political Environment for China's High-Speed Rail

In the diplomatic process of "the belt and road initiative", the Chinese government has repeatedly mentioned that China's high-speed rail industry has clearly stated that China's high-speed rail is not to achieve the hegemony of "dominating the king", but to promote mutual benefit and mutual benefit, which is conducive to cooperation between the two sides, promoting the external development of the contracting parties and protecting them from various uncertain factors. [10] China keeps holding exhibitions related to high-speed rail in the world, constantly publicizing the strength of China's high-speed rail, showing high-speed rail to the international market, and promoting the international influence of China's high-speed rail to create a favorable political environment.

4.1 Improve the Brand Building of China's High-Speed Rail Core Competitiveness

There are shortcomings in the development process of China's high-speed rail. It is necessary to design according to its own situation, compare and analyze the advantages and disadvantages of the old high-speed rail, study the shortcomings of the core technologies of China's high-speed rail, strengthen technological innovation, reduce manufacturing costs, and realize the development of "quality" instead of "quantity" from the advantages of the complete industrial chain such as manufacturing, construction and operation, with the help of the development opportunity of the whole industrial chain under "Made in China 2025". Strengthen the use of huge domestic operational data and improve domestic operational service standards. Improve the international status of its core technology patents and establish international standards for core technologies, expand the brand influence of China's high-speed rail industry, strengthen the advantages of China's high-speed rail technical standards, and promote the international market's comprehensive understanding of China's high-speed rail industry.

4.2 Pay Attention to Personnel Training and Build a Personnel Training System

In China's high-speed rail enterprises, R&D institutions have been established in some countries or regions with R&D advantages to attract outstanding scientific and technological talents. At the same time, aiming at training technical talents, a perfect training system has been formulated, so that young technicians can go deep into the grass-roots learning opportunities and learn basic skills related to undeveloped technology development. For familiar technicians, they should constantly update their knowledge, expand their knowledge horizons and develop the vitality of continuous innovation. [11] At the same time, it is necessary to train talents who are proficient in the language, politics, laws and related systems of the cooperative countries. In order to realize branding and standardization of China's high-speed rail, and even make internationalization accept Chinese standards, enterprises should constantly cultivate outstanding talents. Constantly innovate, cultivate technical and service compound talents.

4.3 Strengthen the International Management System of Chinese High-Speed Rail Enterprises

In the process of attaching importance to the rapid training of talents and technological innovation,

China's high-speed rail should strengthen the international management level of enterprises, cultivate the level of transnational management, understand the economic situation and social culture of the cooperative countries to improve various rules and regulations, adhere to the cultivation of management concepts, be familiar with local laws and regulations, and rationally use laws to protect their own rights; It is necessary to strengthen risk awareness, pay attention to risks in technology, intellectual property rights and finance, establish a complete set of risk management system, and improve the international management system.

5. Conclusion

Based on the above research and analysis, China's high-speed rail has a certain influence, market share and trade competitiveness in the international market, while the national institutional advantages give technical support to the core key of high-speed rail. China's high-speed rail has changed from a pain point in the manufacturing industry to a beautiful business card giving full play to the leading role of the government, strengthening support for science and technology and talents in the high-speed rail industry, making use of innovative resources, and cooperating with national, local and university production, education and research to build an independent innovation research and development strategy for high-speed rail core key technologies and components, so as to enhance the brand building of international competitiveness. Constantly improve the international management system of enterprises, improve the international market mechanism, and strengthen the intellectual property protection of the high-speed rail industry, so that China's high-speed rail can quantify the international market according to Chinese standards.

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