"Software" & "Hardware": The Discussion on the Integrated Development of Chinese Railway ——Based on the Contrastive Discussion of Japanese Railway Development

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Abstract:

China's high-speed railway has developed rapidly and achieved remarkable achievements. In particular, high-speed railway technology has made breakthroughs in the world. However, it is undeniable that China has gradually caught up with and even surpassed the "hard" technology compared with countries with mature railways such as Japan, but there is still a long way to go in the construction of "soft" railway culture. Only through "soft" and "hard", can China's railways fully develop and continue to lead the world.

Key Words: "Software" and "Hardware"; Chinese Railway; Integrated Development; Contrastive Discussion

I. The Historical Review of Chinese and Japanese Railway Development Process

Reviewing the railway development process in China, its role transfers from the tool or medium of imperialist powers invading China to the powerful force to drive Chinese economic and social development, going through lots of unpredictable twists and turns. From "running a pilot railway scheme" in the late Qing Dynasty to "resolutely initiating" before the Sino-Japanese War of 1894-1895, the Qing Government tried to follow the example of the Western railroading system and management style to protect the national sovereignty and

strive for economic rights by railway self-management, government-supervised and merchant-managed, official-merchant joint management. At that time, China confronted with the force threat of the imperialism, the external pressure of encroaching Chinese resources, rights and interests as well as the internal driving force for prospering foreign affairs, depriving economic rights and striving for self-improvement to share a bitter hatred of the enemy by the whole nation. In the late Qing Dynasty, the railway program and construction velocity surpassed the carrying capacity of Qing Government fiscal revenue and governance capacity. Hence, borrowing foreign loans, hiring foreign employees and referring foreign mechanism is the significant way to complete railway construction quickly. Looking back the railway construction in the late Qing Dynasty, it both laid the solid foundation for Modern Chinese Railway Development in the railway construction and railway development. It formed a set of integrated railway management mechanism as well as established a series of railway program management regulations. However, it is undeniable that at that time, the railway rights and interests were captured by the imperialism and huge foreign railway debts was an important feature of the railway construction and development in the late Qing Dynasty. Under the premise, during the process of railway construction operation and debt management, the rights and liabilities between the central and the local governments were unclear which caused they to go their own ways. The fragment was also one of features of the railway construction management in the late Qing Dynasty.

In the Republic of China era, the railway growth was limited to the practical environment of the warlordism at that time, leading to the extreme loss of railway rights and interests: "from 1912 to 1918, British, France, Germany, Russia, America, Belgium, Japan and so forth totally plundered more than 14,000 kilometers Chinese railway rights[①]. The major predatory approach was building the railway by the loan. During the 6 years, the total quantity of foreign powers' railway loans or advances reached to 154,496,729 silver dollars. However, the Beiyang Government only applied 83,754,306 yuan to the railway construction, occupying 54.21%. And the left was used for the army and government expenditure and interest payment"[②]In the Ministry of Railways of National Government period, for the perspective of railway construction, before the Chinese People's War of Resistance against Japanese Aggression (from 1929 to 1937), the new constructed railway mileage came up to 4266.6 kilometers, building 474.04 kilometer averagely per year. In particular, from 1929 to 1932, the newly-built railway milage arrived at 3913.16 kilometers, launching 588.4 kilometers averagely per year[③]. In a manner of speaking, at that period, a wave of climax for railway construction was set off. During the late Qing Dynasty and the Republic of China

① Yang Yonggang. China Modern Railway History [M]. Shanghai: Shanghai Bookstore Publishing House,1997:90.
② Yang Yonggang. China Modern Railway History [M]. Shanghai: Shanghai Bookstore Publishing House,1997:90.
③JinShixuan, Xu Wenshu. History of Rail Transport in China (1876 - 1949) [M]. Beijing: China Railway Publishing House, 1986:596-612.

(from 1912 to 1949) periods, the railway development was featured by foreign power intervention, building railway by loan, expanding slowly and so forth. But we can not deny the Chinese railway development process went through from none to one, from bad to good. From the construction of Woosung Railway in 1876 to Communist Party of China taking over northeast railway in 1945, owing to the influence of war and regime change, as a whole, Chinese railway construction and management was always locate a slow development period.

Since the founding of People's Republic of China, the government pressed ahead the extensive restoration on the railway and the railway became one of the most important traffic facilities to drive national economic and social development as well as to accelerate the socialist construction. But, with the sustainable development of economy especially after the Reform and Opening-up, Chinese economics entered into the rapid growth stage and the railway became the “bottleneck” for restricting national economic development. On this basis, in order to alleviate the imbalance between transport capacity and traffic volume, the railway was undertook the internal revolution. In 1978, when Comrade Deng Xiaoping visited Japan, the Japanese “Shinkansen” curved a deep impression on him and he immediately expressed that China also would spare no efforts to develop railway. Chinese railway’s initiating changes transformed the “bottleneck” for restricting national economic development into the “engine” driving national economic fast growth, driving the railway technologies from backward to advance and even going abroad and leading the world as well as embarked on a road of Chinese railway development mode starting from its specificity.

At this late hour, starting from Qinhuangdao-Shenyang passenger special line being opened to traffic in 2003, with 15 years rapid development, the high speed railway has developed into Chinese bright business card. Till the end of 2017, “the national length of railways in operation reached to 127,000 kilometers, increasing 2.4% on last year. In addition, the length of high speed railways in operation attained to 25,000 kilometers. The national density of railway network was 132.2 kilometers/ thousands of square kilometers, increasing 3.0 kilometers/ thousands of square kilometers on a previous year. And the length of multiple track was 72,000 kilometers, increase 5.4% from a year ago and the rate of multiple track was 56.5%, improving 1.6 percent point than the last year. The electrification length was 87,000 kilometers, raising 7.8% on a previous year and the electrification rate was 68.3%, growing 3.4 percent points from a year ago. In the western region, the length of railway lines in service was 52,000 kilometers, adding 1663.5 kilometers and 3.3%.”[①](as shown in Figure 1). The railway especially the high speed railway really becomes the pillar of a great power. The railway technologies and the talent cultivation have made the tremendous progresses and Chinese railway also realized the stride from "bringing in" to "going out".

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① State Railway Administration Website. 2017 Railway Statistical Bulletin,[Online].2018.04.12.http://www.nra.gov.cn/xwzx/zlzx/hytj/201804/t20180412_55248.shtml

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Figure1: Data Sources State Railway Administration Website, 2017 Railway Statistical Bulletin.

全国铁路营业里程:National Length of Railways in Operation

万公里:Ten Thousand Kilometers

营业里程:Length of Railways in Operation

复线里程:Multiple Track Length

电气化里程:Electrification Length

Although the railway appeared in Chinese and Japan in nearly simultaneous, their railway development are widely divergent for the fundamental realities of the country, people's cognition as well as the distinguishes of governmental railway policies. As one of the fast-growing Japanese social production lines, Japanese railway takes the lead of Chinese railway for the long term about technical content, planning layout and managerial experience. In general, Japanese railway development totally contains six phrases: Railway Dawn Period for Exploration (1870 - 1890), Establishment Period of Domestic Railway Technologies (1890-1930), Golden Age of Railway Transportation (1930 - 1950), Leap Period to The World Top One (1950 - 1970), Accumulation Period of Facing to the Future (1970 - 1990) and Mature Period of Diversified Railway (1990 to present). In the world, the first operated high speed railway is the Japanese Tokaido Shinkansen which is opened on October 1, 1964. After that, the Skinkansen plays a significant role in Japanese urban development and people transportation. Up to 2015, the total length of Japan railway was 27,311 kilometers, including standard gauge 4,800 kilometers, narrow gauge 124 kilometers. And for the multiple tracks, the 1.435-1.067 m gauge was 132 kilometers, the 1.067 m gauge was 22,207 kilometers and the 0.762 m gauge was 48 kilometers. In Japanese daily life, not only the Shinkansen plays a key role but also the railway generates the fundamental effects on the whole Japanese economic and social development as well as people transportation.

In fact, for the early stage, Chinese and Japanese railway development histories enjoy the similarities - the imperialist countries imposing to the feudal governments. But the two governments and people posed totally different attitude to the railway. In the early stage, Japanese railway adopted the European and American capital, technologie and talent injections. In other word, during the original period, Chinese and Japanese railway development is by the introduced approach. Of course, it was a kind of passive introduction and both parties assimilated and absorbed the railway technologies. From the perspective of both countries' historical process, till the 21st century, in regard to the railway technologies assimilation and absorption, Japan performed better than China. At the same time, Japanese railway channeled great efforts to develop their own technicians and press ahead recreation so that it was the major reason for Chinese railway lagging gradually. Entering into the 21st century, in special, the start of high speed railway construction, Chinese railway technologies gain the rapid growth and the railway hard power is reinforced constantly.

II. The Improvement of "Hardware": Comprehensively Master Railway Technologies

Chinese railway development is always learning widely from others' strong points. In the late Qing Dynasty and the Republic of China era, it was called "Museum of Universal Haulage Motors". After entering into the new century, Chinese railway development keeps a foothold and takes the procedure of introduction, assimilation and absorption to the extreme. On this basis, it also presses ahead the technologies recreation as well as combines technologies and experience, technologies and innovation, technologies and national conditions. Thus, it forms a world first class high speed railway technological system which caters to Chinese national conditions and transportation situation, walks a technological innovation route with Chinese characteristics as well as builds up the largest, most perfect operation velocity and system and the most advanced technological high speed railway operation network. The keys to Chinese high speed railway success and to master technologies comprehensively are to stick to "the high speed railway technological innovation route which is led by government, takes the enterprises as subjects, introduces the combination between critical technologies and integrated innovation, the joint of engineering practices and assimilation, absorption and the unit of the original innovation and upgrade, improvement and re-innovation as well as integrates the production, education, research and application together."[①]

Generally, the growth and master of Chinese high speed railway technologies innovation could be divided into four stages and each stage enjoys the representative lines: firstly, it is the technological reservation stage. The representative lines are mainly the Qinhuangdao - Shenyang dedicated passenger railway and Shaanxi - Chongqing dedicated passenger railway.

[①] Liu Hui. The Innovation and Development of Chinese High Speed Railway [J]. The Science of Leadership Forum, 2018(6):42-62.

During this stage, China also acquired the passenger transport line of speeds of 200 kilometers an hour as well as developed transportation integrated bridge girder erection machine. Secondly, it is the introduction and assimilation stage. The representative line is the construction and operation of Beijing to Tianjin inter-city high-speed railway lines. Thirdly, this stage is adsorption and innovation and the representative lines are the constructions of Zhengzhou-Xi'an, Wuhan-Guangzhou passenger special lines. Fourthly, this stage is self-dependent innovation. The representative line is the construction of Beijing Shanghai High Speed Railway which is also the symbol of China to formulate the full set of proprietary intellectual property rights on high-speed train. Achieving mastery through a comprehensive study of the four stages, based on referring the foreign correspondent technologies, Chinese high speed railway presses ahead the innovation as well as possess the proprietary intellectual property technologies in line with the domestic demands which are mainly demonstrated in the following aspects: 1. for infrastructure, it includes subgrade construction technologies, tunnel construction technologies, transition section technologies, ballastless track technologies and high-speed turnout junction technologies; 2. for traction and control: traction power supply technology, train control and communication technologies, joint debugging and commissioning technologies; 3. for operation and maintenance: operation maintenance and management technologies, the integrated high speed railway service life and period concept; 4. Standardization. The promotion of the above mentioned technologies formulated the four technological systems with Chinese proprietary intellectual property rights, namely construction technological system, equipment manufacturing system, technological standard system and operation maintenance system.[①]

After more than ten years development, Chinese railway technologies, especially the high speed railway technologies have caught and even surpassed the high speed railway of the developed countries. In order to further accelerate Chinese high speed railway development, the government published the high speed railway network medium and long-term plan in 2016. The plan proposed that China is planned to build up the "eight vertical and eight horizontal" high speed railway network. Chinese high speed railway will reach to 30,000 kilometers in 2020 and to 50,000 kilometers in 2030. High speed railway network construction would cater to the demand of Chinese economic growth. And the establishment of the "eight vertical and eight horizontal" high speed railway network predicts that based on the existing railway network, it would form the systemic structure combining high speed railway network, ordinary railway network and comprehensive transportation junction as it works to improve the four transportation (railway, highway, shipping and aviation) system network. At the same time, the high speed railway coverage is wider, the distribution is more rational as well as the layer is clearer, making the high speed railway be

[①] Liu Hui. The Innovation and Development of Chinese High Speed Railway [J]. The Science of Leadership Forum, 2018(6):42-62.

one of the important basement for Chinese economic rapid growth.

With mastering the core technologies, Chinese high speed railway still further channel more efforts to design, research and develop, manufacture and application, changing the Chinese high speed railway to the example for global high speed railway development. On this basis, country starts to launch a series of technological standards for high speed railway as well as continues to stimulate the technological innovations. In 2014, National Railway Administration of PRC issued The Design Specifications on High-Speed Rail which regulates high speed railway design velocity, technological specification, main track number, main track midway, minimum plane curve radius, maximum gradient, train operation control system, minimum running interval, dispatch command approach and other technological standards. Hereafter, it upgrades the standards and technological result banks year by year. Only in 2017, the country manufactured a series of important technological standards in railway industry and stored railway major technological results into the bank. "The major technological standards formulate: issuing 7 batches of railway industry technical standard announcements, publishing 89 railway industrial technological standards, such as AC Drive Electric Locomotive, The Technical Specification of ZPW-2000 Track Circuit, revising 13 railway engineering construction standards including Code for Design of Heavy-haul Railway, Code for Design of Railway Line and so forth, releasing 18 railway engineering cost standards like The Preparation Method on The Estimate (pre) Calculation of Railway Capital Construction, publishing 25 the English version of railway industrial technical norms such as Bogies for Multiple Unit Train, releasing 10 English version of railway subject design code like Code for Design of Earthworks and Track Bed for Railway as well as releasing 1 such as A Dictionary for English Translation of Railway Technical Standard and so on. As for the intellectual property and award research products: it completed to put 50 railway major technological and innovative results into the railway technological project library, 50 railway patents, 26 railway technological standards and 179 railway technological papers."[①]The storage of these industrial codes and technological innovation demonstrate the promotion of Chinese railway technological proprietary intellectual property rights as well as comprehensively possess and master of railway technologies.

Once upon a time, the technologies particularly the core technologies are the Achilles' heel of restricting Chinese railway growth. With implementing the national strategies successfully and introducing, assimilating, absorbing and recreating high speed technologies, China becomes the possessor and exporter of high speed railway core technologies. But we should still remember that the core technologies are the hard currencies. Through hundred years development process and efforts of several generations, China gradually masters the

[①]State Railway Administration Website. 2017 Railway Statistical Bulletin,[EB/OL].2018.04.12.http://www.nra.gov.cn/xwzx/zlzx/hytj/201804/t20180412_55248.shtml

core issues of ordinary railway and high speed railway technologies. But we shall consider that is it enough the Chinese railway growth only possess technologies? Viewing from Japanese railway, you could find that the railway technologies not only take a leading position but the railway software still should not be overlooked. In order to realize the integrated development of railway, only relying on technologies is not able to solve all problems. Lets discuss that will happen to the "forcibly occupy a high-speed train seat" phenomena if the people possess the strong railway sense? Of course, this phenomenon is the minority and closely related to personal conducts. It is undeniable that the education of Chinese railway culture far fell behind the railway development step. In particular, in comparison with Japanese railway culture, the "Hardware" becomes strong but the "Software" is still weak. Obviously, we still have a long way to go.

III. Shortcoming of "soft culture": railroad culture to be explored

Culture is a social and historical phenomenon through the long course of human creation, and also the sediment of human society and history. In other words, culture, in the material but besides it, form material but above it, serves as history, custom, tradition, lifestyle, art and value that can be inherited. Or culture is seen as the continuing ideology generally recognized in mutual conversation among people and the sublimation of sensible knowledge and experience towards real world. Culture is typical of inheritance, meanwhile, railroad, as the material carrier, has created its own culture after years of development. Since nearly one hundred years from late Qing dynasty, China has experienced from a weaker to a stronger and from a technology importer to an exporter in railroad. In terms of culture, we can see that there are many industries and literature related to railroad culture, but compared with Japan, we have not developed a set of extensive system, which results in the fact that railroad culture is not popular, especially without drawing attention of railroad industries and the public.

As the developed country in Asia, Japan has witnessed the fast development of its railroad, inparticular, what it has gained in railroad in recent fifty years is remarkable. While focusing on the railroad technology, Japan also shows its distinct passenger service culture through compartment, station and other visual designs. Moreover, Japan pays more attention to the development of railroad culture heritage and its historical value, for example, it will mark "Railway Memorial" and "Important Railway Memorial" on some railway heritages. Besides, Japan railroad is co-run by many companies, but each of them has its own railroad museum with people-oriented devices. Taking Qiyu Railway Museum as an example, there are history, railway science, future railway development and tourist experience exhibition areas. In history section, you can know some about how Japan railway develops. The large screen on the wall above vehicle stage will provide charming influence and sound as well as performance where light can be felt active. Vehicle section will show that a turntable performs live rotations of C57 steam locomotive and EF55 electric locomotive. On the wall

of this museum is railway vehicle chronology in ways that illustrate the railway history since Japan begins to build, as well as representative models which help visitors understand what the vehicles evolve in visual, auditory and tactile ways. Railway science section, themed as science of railway, aims to explore the uncertainties hidden in railway and to identify its structure from scientific perspective, deepening the knowledge about railway. Future railway development section, themed as future of railway, gets people involved in making the railway safer, securer and more comfortable in the future. In addition, the sand table model and driving experience of Shinkansen line railway are also established. In short, visitors are not only able to comprehend railway development, but to enjoy driving, thus such interaction will help people know more about railway culture.

Though the railway is an imported good in Japan, its growth benefits from the national learning ability by nature. Japanese soon accept this new thing which brings them convenience and profound influences on every aspect of life. Since Meiji period, this new vehicle has affected such Japanese literati as Ozaki kouyou, KōdaRohan, Moliogai, NatsumeSōseki, KataiTayama and ShimazakiHaluki who describe the smoke of a steam train in their works. With the development of railway and technology, railway literature comes one after another. People born after 1980 or 1990 must be familiar with Hikarian created by both Ministry of railways and ministry of culture in Japan, whose purpose is to advocate and promote railway culture and Shinkansen line. That is to say, this is a promotional film impressed by numerous children. Besides, bento, Japanese special railway food, is necessary to every long-distance passenger, and also the high-quality carrier for the promotion of culture in the areas along the railway route. As such, travel books of many types are published to introduce bento at railway stations, such as food comic Railway Bento with the core of tasting bento. The bento rice is very delicious in Qiutian and Xiantai rich in rice while Chinese shaomai and dumpling are best sellers in Changqi, Hengbin and Shenhu where many Chinese gather.

As railway is closely linked with culture through words, films, music, pictures, paintings and foods, Japanese railway culture is developed and inherited better. The major reason why Japanese railway can grow so fast and take the lead in the world is its focus on the development of railway culture. Since their childhood, Japanese have gotten to know, interacted with and cultivated an interest in railway, which enhances their curiosity and help to develop railway in turn. China has, of course, seen great progress and increasing prosperity respectively in railway mileage, speed and transportation as well as railway culture. In 2003, China Railway Museum was established, marking the fact that China boasts a national museum that will collect, protect, research and educate railway culture. Afterwards, Shanghai, Shenyang and Harbin have established local railway and line museums to collect, organize, present and spread railway culture and knowledge as well as highlight local specialties, which plays an important role in the record and promotion of one hundred years of railway history

as well as the protection of historical relics and documents. Compared with Qiyu Railway Museum in Japan, however, the national museum must do better in its collections, exhibition forms and interactions with visitors. It is actually an exhibition hall rather than a vehicle museum, lack of emotion, creativity, communication with visitors and detail description about history, present and future. Many literature and art works related railway are created after its emergence, such as recent animation work High iron Man, but it gets ordinary response. As most of those who create railway literature have ever engaged in railway-related jobs while less people specialize in this aspect, there are no influential works accepted by the public and no ways to reflect China's railway spirits and cultural features.

Though China has exceeded Japan in such hardware standards as railway speed, mileage and technology, we must admit that we remain lag far behind Japan in railway culture. The saying, of course, is not worshiping foreign countries, nor defeating ourselves, but indicates that it's urgent to match railway development with its culture as high-speed train technology keeps growing. In this new era, China has the great potential to explore railway culture on the basis of cultural confidence. The development of soft culture should catch up with that of technology. To reach holistic railway growth, China has to supply culture with technology.

IV. Combination of "Soft" and "Hard": Chinese Railway Development in Comparative Perspective

Through the comparison between the Chinese and Japanese railways, we could not only understand the remarkable achievements in the development of Chinese railways, especially the technological progress, but also find out the shortcomings in the development of our railways. To carry on the comparative research scientifically, can draw lessons from experience to enrich oneself, and then to make up short-board. Of course, it is necessary to try to avoid only looking at the phenomena with regardless of the nature, and focusing only on the present rather than looking at the future problems. On the basis of the reality of railway construction and development in our country, the historical development of the Japanese railways and the construction of the railway culture would be taken as the reference to comprehensively and objectively discuss the achievements and shortcomings of railway development between the two countries, so as to draw a scientific and correct conclusion in order to provide helpful reference to the exploration of the overall development of China's railway and to further promotion of the construction of railway modernization in our country.

Extending from the historical process of Sino-Japanese railway development, after a comparative study of the fundamental sequence of Sino-Japanese railway development, it can be found out that, China, as a rising star in railway development, especially in the high-speed railway development, has caught up with or even outpaced Japan's railway in terms of technology, that is to say, it has made a breakthrough in its "Hard" power. However, it is obvious to lag behind the latter in terms of its "Soft" power, such as scientific research, literary

and artistic creation, and cultural propaganda related to railways. Since the 18th CPC National Congress, General Secretary Xi Jinping has carried out a series of expositions on cultural confidence, emphasizing to assert in the road to socialism with Chinese characteristics, while those both in theory and in system are ultimately to insist on cultural confidence, which remains the confidence more fundamental, broader, and deeper. Therefore, with the development of high-speed railway, it is the key to the overall development of Chinese railway on how to enhance the construction of railway culture while upgrading the technology, that is, a combination of "Soft" and "Hard".

On the one hand, the maintenance and innovation of “Hard”. Technical competence, especially the maintenance and innovation of core technology, is the key to keeping the lead. First, to enhance the innovation of railway technology, especially the core technology. The development of the railway has experienced the development of the steam age, the internal combustion engine age, and the electricity age. During this period, China has gone through a difficult process from the introduction, digestion, absorption to re-creation, which also taught us how important it is to master core technology. In his speech at the Meetings of the CAS and CAE on June 8, 2018, General Secretary Xi Jinping stressed: "There is a growing trend of cross-integration between disciplines, between science and technology, and between technology, in association with between natural science and humanities and social sciences. Never before has science and technology profoundly affected the future and destiny of a country. Never before has it had a profound impact on the well-being of people's lives." Therefore, it is necessary to strengthen the investment in railway technological innovation, especially in the subversive core technology, so that we can take a step forward on the basis of maintaining the technological leadership. Second, to cultivate a majority of railway technicians. Man is the main body and foundation of scientific and technological progress, and all the achievements of scientific and technological innovation are made by human beings, whether it is soft power or hard power, the most important thing is still the strength of talent. Therefore, in the process of high-speed railway development, we must improve the talent rank, while colleges and university as well as research institutes should cultivate a group of talented technologists who can bear hardships and stand hard work in order to maintain the leading technology. Of course, it is necessary for the state and society to provide an excellent environment for cultivation and innovation in order to cultivate talents, to consolidate the fertile soil for the cultivation of talents, and to establish a mechanism which is conducive to the cultivation, use, competition and motivation of talents. Only in this way can we really cultivate the railway technical talents who can enter the scene, carry out scientific research and know both theory and practice. Third, to establish a set of technical standards in line with the condition of a country. In the process of high-speed railway construction in China, more and more attention has been paid to the establishment of Chinese standards. Thus, mastering technology is no longer the only goal for railway development, especially

high-speed railways. On the basis of mastering technology, the establishment of China its own standards with the recognition of the international community is the real symbol of China's high-speed railway technology leading the world. In recent years, the state has also issued a series of regulations on high-speed railway technical standards and established a set of Chinese standards. However, these technical standards are far from enough compared with the speed of technological innovation of high-speed railway. In addition, there is also a long way to form a complete system. Therefore, it is necessary to continue to enhance the technical standards in line with the national conditions.

On the other hand, the promotion and development of "Soft". The enhancement of the research on railway cultural construction and railway soft power is the only way to make up the short-board in an all-round way. First, to integrate railway resources and develop railway culture. The integration and consolidation of railway resources requires the participation of many parties and the understanding of the historical development of Chinese railways. This requires enhancing the related research on railway history to enhance the integration of resources among enterprises, railway bureaus, colleges and universities, and individuals and to promote the research of railway cultural relics, railway social history and railway economic history, as well as to protect the railway buildings and railway objects of historical importance. At the same time, we should speed up the construction and investment of the railway museum, and turn the existing isolated railway exhibition hall into a modern railway museum with two-way interaction. Only through the establishment of interactive museums can ordinary people get more interested in railways, be better aware of railways, and be more willing to devote themselves to the protection or construction of railway industry. Second, to strengthen the research and creation of railway "soft" science. Culture is the product accumulated by several generations, which has been passed on through education from generations to generations. With the development of society, the role of knowledge and scientific culture in social life is played increasingly day by day, which is the key factor of production development and social progress. With the rapid development of high-speed railway construction in China, the research on railway economics, railway sociology and so on have sprung up one after another, while researchers who linked high-speed railway construction with urbanization construction, high-speed railway and national economic development, have been coming forth one after another. However, there is no denying that this kind of research is still rather backward compared with the current railway development. While paying attention to the development of technology, the relevant "soft" science can keep up with the pace of railway development so as to truly realize the overall development of railway. Therefore, we should strengthen the research and creation of railway "soft" science, which is an important way to develop railway in an all-round way by studying not only the railway people and affairs but also the influence of railway. Third, the construction of railway culture should be rooted in the railway itself. The culture of directional function can restrict and shape people's cognition, and

this mode of thinking and value system, once finalized, will form a potential inertial force so that restrict the way to understand and transform the world, and affect the future trend of the affairs or world to be transformed. In this respect, railway cultural construction should be rooted in the railway itself. Only in this way can we produce cultural products that are closely related to the railway and form the cognition and mode of understanding and reforming the railway. It can also be said that the success or failure of socialist railway cultural construction is related to the future fate of Chinese railway development.

The original intention of comparison is not to measure which is better or worse, but to continue to enhance the leading position of Chinese railway technology and to make up for the deficiency encountered in the development of Chinese railway. Only in this way can we promote the overall development of railway. Objectively speaking, the modernization development of Japanese railway is generally higher than that of Chinese railway. For example, the driverless trams and suspension trams, which are now in operation in Japan, are already ahead of the world. The technological leadership can often be manifested directly through hardware facilities, but the cultural construction of railway is the ultimate engine of the sustainable development of technology. Therefore, the overall development of Chinese railway must be combined with "soft" and "hard", only in this way can it provide continuous power for the development of Chinese railway.