

# Research on the Innovative Development of China's Comprehensive Transportation System

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The comprehensive transportation system is the intensive development stage of the transportation industry, which has gradually become the mainstream transportation mode in the world by giving full play to the advantages of different modes of transportation, promoting the effective use of resources, saving energy and reducing environmental pollution. Since the beginning of reform and opening up, China has achieved a steady improvement in the quality of transportation and a rapid growth in quantity, and has made remarkable achievements in stimulating economic growth and improving people's well-being. During the 14th Five-Year Plan period, China's comprehensive transportation development will continue to take into account the basic needs and diversified needs, promote the diversified and high-quality development of transportation services, gradually realize the enjoyment of people's travels and the smooth flow of goods, and continuously meet the growing needs of the people for a better life. We must follow the general idea of "forcing market entities to take the initiative to compete, guiding the development of emerging industries, cultivating the core carrier that drives the integrated development of transportation services, improving regional transportation coordination capabilities, and comprehensively using cutting-edge technologies", constantly innovating and making breakthroughs in infrastructure, technological innovation, institutional mechanisms, investment and financing policies, and promoting the innovative development and overall leap of China's comprehensive transportation.

**Keywords:** comprehensive transportation system, transportation power, industrial policy, innovative development

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## 1. Introduction

Throughout the development of the world's transportation industry, comprehensive transportation is a scientific concept arising from people's pursuit of higher quality transportation services due to economic development and improvement of quality of life. Its basic requirement is to build a transportation system with the least consumption of social resources to meet transportation needs, or to complete transportation activities at the lowest cost. It can be seen that the comprehensive transportation system is the

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intensive development stage of the transportation industry, and by giving full play to the advantages of different modes of transportation, promoting the effective use of resources, saving energy and reducing environmental pollution, it is becoming the mainstream mode of transportation in the world. It should be pointed out that comprehensive transportation is not simply a combination of various transportation modes, but focuses on “closely coordinated, complete and unified” comprehensive transportation, that is, a full, seamless, and continuous transportation process with the primary goal of solving the problems of connectivity and multimodal transportation, as well as the economic, technical, and organizational systems for achieving this process. Among them, the comprehensive transportation hub is the key node of the comprehensive transportation network, the main carrier of the efficient connection and integration of various modes of transportation, and plays an important role in improving the efficiency of the comprehensive transportation network, optimizing the transportation structure, improving the level of multimodal transportation development, and accelerating the transformation and development of transportation.

The Chinese government has always attached great importance to the development of the transportation industry. The report of the 19th CPC National Congress proposes to build a “transportation power”, which means that China will start a new journey of building a transportation power in the new era. The transportation power in the new era is not a strong transportation industry, but to build a strong comprehensive transportation system to better serve the rapid and high-quality development of the economy and society and meet the people’s strong demand for improving transportation conditions and improving travel efficiency. The development of the comprehensive transportation system is a new trend and new direction for the development of contemporary transportation, but comprehensive transportation involves complex competitive relations. Scientifically handling the various relations and convergence of the development of the comprehensive transportation system is a huge challenge, which requires innovative ideas, comprehensive policies, and scientific advancement. This paper is guided by the strategic thinking of “strengthening the country through transportation” put forward in the report of the 19th CPC National Congress and closely combines the relevant deployment of the “14th Five-Year Plan for the Development of a Modern Comprehensive Transportation System”, analyzes the problems encountered in the innovation and development of China’s comprehensive transportation system, and explores the ideas and countermeasures for promoting the innovative development of China’s comprehensive transportation system.

## **2. The Main Problems in China’s Comprehensive Transportation System**

### *2.1. The Problem of the Management System of the “Big Transportation”*

At present, to a certain extent, China’s traffic management system has the

problems of low management level, multi-sectoral governance, and vague powers and responsibilities. The management functions at different stages of the operation of the transportation system are divided by different departments, and there is a phenomenon of mutual prevarication and wrangling in the actual traffic management. The management subjects of different modes of transportation are different, and the uniformity of the management departments of railways, highways, and public transportation needs to be improved, and various forms of traffic management methods have emerged. Various traffic management methods are independent of each other, and traffic management functions are dispersed, making the functions of different departments overlap, and there are also management gaps. Due to the inconsistencies in the traffic management methods of different departments, it is necessary to achieve a management consensus through multi-faceted coordination. Sometimes, driven by departmental interests, it is difficult for various departments to form a unified opinion, resulting in a decrease in the efficiency of specific decision-making actions. For example, the comprehensive administrative law enforcement of transportation is ineffective, there is a lack of a regularized, specialized, and standardized law enforcement team, and the overall development mechanism of highways and ordinary highways is not perfect.

### *2.2. The Intensity of Transportation Marketization Reform*

Due to historical reasons, the transportation sector is a sector with a relatively slow pace and relatively small intensity of market-oriented reform in China. For example, government-protected transportation enterprises have a low sense of competition and low work efficiency in the process of operation and management, making it difficult for them to provide better services to the broad masses of the people. This reduces the efficiency of China's transportation market as a whole. At this stage, in the process of transportation marketization reform, the government monopoly has not been completely broken. Under the intervention of the government, the decision-making ability of transportation enterprises is weak, the flexibility of operation and management is low, the enthusiasm is insufficient, and the ability to assume profits and losses and operate independently is poor, making it difficult to establish the status of the market entities, which greatly reduces the long-term development ability of enterprises.

### *2.3. Transportation Investment and Financing Channels*

At present, China's transportation investment and financing model is difficult to meet the needs of transportation development, especially it cannot meet the requirements of the state to deepen the reform of the fiscal and tax system. On the one hand, the main role of government investment is not strong, and financing is difficult. With the increase in the

price of various construction materials in recent years, as well as the increase in labor costs, the unit cost of basic transportation facilities projects has been rising, and the traditional model of government fiscal expenditure as the main source of funds has been difficult to meet the needs of project construction. If the country continues to follow the government's single fiscal investment method and does not establish a perfect social investment and financing model, it will lead to increasing financial pressure on local governments and face the risk of reducing the government's credit rating. Moreover, as the income of some construction projects does not meet the expected requirements, affecting local fiscal revenues, resulting in the weakening of the financing capacity of later construction projects, the development of investment and financing will form a vicious circle. On the other hand, due to the characteristics of large investment, slow returns, and long cycles in the construction of transportation infrastructure, a large amount of social capital lacks investment confidence in such projects, which has an adverse impact on the investment and financing development of China's transportation infrastructure construction.

#### *2.4. Unbalanced Layout of Transportation Networks*

At present, China's various modes of transportation have shown the layout characteristics of "dense in the southeast and sparse in the northwest" to varying degrees. Transportation is closely related to the regional economic development, and the advantage of occupancy of transportation resources determines the advantages of regional economic development to a certain extent. Transportation costs remain high in areas lacking transportation resources. In the context of modern industrial development with a high degree of inter-industry correlation and a high degree of specialization, it is difficult to form a further division of labor in industries, which will affect the regional economic development and further widen the gap between the rich and the poor with respect to transportation resources. Uneven development of interregional transportation networks has led to different problems faced by different regions. The market scope of various modes of transportation overlaps to a certain extent, there will be competition in some areas, and when the layout is unreasonable, there will be a disorder of competition (Zhang and Pan, 2021).

The spatial layout characteristics of "dense in the southeast and sparse in the northwest" also make the competition between various modes of transportation in the east and south excessive to a certain extent, resulting in the waste of transportation resources. In areas with sparse road network density in the northwest, there is insufficient competition in various modes of transportation, and some areas are monopolized by one mode of transportation, which is not conducive to the economic development of the region and the development and growth of transportation enterprises. The imperfect layout of the transportation network is mainly reflected in the difficulty of efficiently connecting the main channel of transportation with

the secondary trunk line and the branch line. Highway network connectivity is low. Although the total mileage of highways is relatively large, the traffic volume of some sections of national and provincial highways exceeds the designed traffic capacity, and the road accessibility in underdeveloped areas, especially in mountainous areas, is not enough, and cannot be effectively connected with highway networks, railway networks, airports, wharves, etc. The layout of railway corridors needs to be further improved, and the corridor capacity in the northwest and southwest regions needs to be further improved. In addition to Beijing, Guangzhou, Shanghai and other cities with relatively complete rail transit, most of the urban transportation network in the city is still mainly roads, supplemented by a small number of rail transit. There is no efficient connection between the junction and other modes of transportation, and the traffic distribution and guidance are unreasonable, resulting in traffic congestion, narrow urban space, and difficulty in capacity scheduling (Zhao and Li, 2018).

### *2.5. Efficiency of Transportation Structures*

On the whole, China's multimodal transportation development strategy is lacking, the strategic logic is unclear, the development policy is departmentalized and fragmented, more is "talking about intermodal transportation on the basis of intermodal transportation", and lacks in-depth linkage with modern industrial layout, industrial cluster cultivation, development space expansion, and technological progress and upgrading. To a certain extent, the development path is divorced from the reality of the stage of industrial development. For example, under the non-standardized and non-containerized conditions, excessive emphasis is placed on container multimodal transportation across developments. For another example, the standard specifications of multimodal transportation are not uniform, and the market environment needs to be optimized urgently. There is a lack of standards and norms for multimodal transportation services, and a lack of rules and guarantees for the transfer of goods between different modes, which results in low efficiency and continuous disputes. The order of the transportation market is not good, the price comparison relationship is distorted, vicious competition such as highway overloading and low return prices is frequent, and multimodal transportation lacks cost advantages and is not competitive. The transportation documents are not uniform, the circulation procedures are cumbersome, and most of the waybills lack financial derivative functions. Insufficient information interconnection and sharing, and the problem of "information islands" is prominent (Zhou and Liu, 2018). The root cause of the inefficient transportation structure lies in the unreasonable structural division of labor among various transportation modes, and how to coordinate and cooperate with various transportation modes, how to make overall plans and construction of transportation facilities, how to organize production of transportation equipment, and how to form a joint force in the operation and

management of transportation have not been solved. In the allocation and utilization of resources, the preference for transportation modes that need to be prioritized is not enough, limited resources are often dispersed, and the overall benefits of comprehensive transportation are not effectively brought into play.

### **3. Countermeasures for the Innovative Development of the Comprehensive Transportation System**

#### *3.1. Promote the Optimization of Infrastructure Networking and Improve the Structure of Comprehensive Transportation Networks*

The efficiency of the comprehensive transportation network should be improved and the cost of transportation and logistics should be reduced. Focusing on the realization of “one network” of comprehensive transportation, with the comprehensive transportation channel as the main skeleton and the comprehensive hub as the key connection point, we will strive to create a high-quality rapid transportation network, an efficient ordinary trunk line network, and a wide coverage basic service network, and accelerate the formation of a high-quality three-dimensional interconnected comprehensive transportation network pattern. We should focus on serving the construction of the “Belt and Road” and strive to promote the “four-in-one” connection of transportation infrastructure on land, at sea, in the sky, and on the Internet. Efforts should be made to use information technology to optimize transportation operation and management control, improve intelligent decision support and supervision, and accelerate the realization of digitalization, networking, and intelligent operation of transportation infrastructure and means of transportation. It is also necessary to focus on adapting to the popularization and application of new technologies such as automatic driving and new energy, and accelerate the research and layout of a new generation of transportation infrastructure to match.

In accordance with the layout of comprehensive transportation channels, we should coordinate the transportation needs of different levels, further improve the functional structure of the comprehensive transportation network, and improve the overall utilization efficiency of the network. It mainly includes: First, construct a rapid transportation network, with the goal of forming an international comprehensive transportation portal, with the acceleration of high-speed railways, highway construction, and the improvement of the layout of civil airports as the main starting point, to improve the ability of rapid transportation access, and to accelerate the construction of an internationalized and regionalized rapid transportation network. Second, build a specialized cargo transportation network, take the main coastal ports as the fulcrum, and strengthen the construction of the collection and transportation network such as sea channels, inland waterways, dredging railways, and dredging

highways. Accelerate the improvement of oil and gas pipeline networks. Third, improve the regional intercity transportation network, combined with the layout of urbanization in various regions, focus on promoting the construction of intercity transportation in urban agglomerations, and build an intercity transportation network with intercity railways and highways as the backbone. Fourth, improve the urban public transportation network, implement the public transportation priority development strategy, combine the actual development needs of the city, build a convenient public transportation service network, and steadily increase the share of urban public transportation. Fifth, in combination with the layout of comprehensive transportation channels in the country and various regions, improve the functions of major urban hubs, improve the service level of comprehensive transportation hubs such as airports, ports, railways, and highways, and build an integrated and efficient comprehensive transportation hub.

### *3.2. Deepen the Market-Oriented Reform of Transportation and Accelerate the Transformation of Departmental Administrative Functions*

We should comprehensively clean up the administrative approval and other functional matters of transportation departments, accelerate the establishment and improvement of the transportation rights and responsibilities list system, clarify the responsible subjects and power operation processes, and standardize the administrative powers of transportation. We should study and publish a negative list for the transportation market. We should innovate methods of transportation supervision from beginning to end, and strengthen mechanisms for social supervision, incentives for trustworthiness, and punishment for acts of bad faith. We should improve the qualification examination and bid evaluation methods for bidding of transportation construction projects, encourage electronic bidding, and strengthen the management of bid evaluation experts. We should establish mechanisms for credit information filings and exchanges and sharing, improve the social credit reporting system in transportation and the categorization and grading management system of market entities, and gradually establish a comprehensive credit assessment and evaluation system with mechanisms for supervision, appeals and review. We should carry out special reform pilots for transforming departmental administrative functions in some areas, realize the division and effective connection of responsibilities between administrative licensing agencies and law enforcement agencies, form a joint regulatory force, and improve the level of industry supervision.

The management model of the giant department should shift from the traditional “planning-approval” system to policy management. Transportation is a typical area of public policy implementation in all countries, and the Ministry of Transport must improve the level of policy management from merely meeting the general call of the movement to implementing public policy in its entirety. Policy is the guideline for the government

to allocate resources, planning is a means for the government to allocate resources, and policy is functionally higher than planning. It is generally believed that there are multiple policy tools in the transportation sector, such as public facility construction, public service provision, tax, subsidies, supervision and privatization, planning is only one of the many tools in public construction (other tools also include standards, investment, financing, construction, ownership and operation, etc.), and not all development problems can be solved by planning, and the ability to use multiple policy tools must be mastered as soon as possible. Therefore, to deepen the reform, it is necessary to dilute the original investment functions of government departments as soon as possible, strengthen their public management and service functions, vigorously promote the reform of the supervision and governance system, standardize the implementation of government procurement of transportation facilities and services, and give play to the role of the public in participating in social organizations.

Since various modes of transportation have long been subordinate to different departments, resulting in the fragmentation of transportation regulations, many of which overlap, and some of which are contradictory to each other. Therefore, it is particularly important to strengthen the coordination of policy innovation. We should continue to deepen the reform of “streamlining administration and delegating power, improving regulation, and “upgrading services”, and do a good job in revising relevant rules and regulations around the reform of the administrative approval system, the reform of “separating operating permits from business licenses”, and the new requirements for safety development. We should do a good job in the new batch of canceling, decentralizing, and reducing the number of approval items, promptly sort out the “the random selection of both inspectors and inspection targets and prompt release of results” supervision practices and experiences, guide and promote the reform of “separating operating permits from business licenses” in transportation, and further consolidate and deepen the work of cleaning up and standardizing various penalties and inspections and enterprise-related fees in the field of transportation.

### *3.3. Optimize the Structure of Transportation and Promote the Coordinated Development of Various Modes of Transportation*

The coordinated development of various modes of transportation is the fundamental requirement for building a comprehensive transportation system. The structure of the transportation industry refers to the constituent elements of the transportation industry system and the constituent proportions among them, as well as the interdependent and mutually restrictive constituent modes, and cooperation or competition relations. From a narrow point of view, the structure of the transportation industry includes the proportion composition and combination of different modes of transportation in the total volume of passengers and goods in transportation, and from a broad perspective, the structure of the transportation industry includes the relationship between the proportion of transportation facilities and the distribution



of space and time, etc. The structure of the transportation industry is jointly determined by the national and regional transportation industry policies, location conditions and other multi-dimensional factors. It directly affects the product structure and service quality of transportation, and is the key link to achieve the balance of total supply and demand of transportation. Establishing, adjusting and optimizing the structure of transportation industry is an objective requirement for maintaining the coordinated development of different modes of transportation, making full use of transportation infrastructure, and improving economic and social benefits (Xu and Jiang, 2021).

In the field of multimodal transportation, the interconnection of facilities and means of transportation as a hardware basis is of course important, and it has also received attention and promotion from government departments for many years, but it is more important that multimodal transportation must also realize close docking of relevant service levels, operating processes and information systems between modes. In this regard, it is precisely more necessary to give play to the role of the market mechanism, relying on the enterprise to give full play to the ability of business and organizational innovation, so the promotion of multimodal transportation needs to form a sound industrial policy structure system. Here, we take the typical mode of multimodal transportation, i.e. container sea-rail transportation, as an example. Although China's port container capacity has long ranked the first in the world, port container collection and transportation still mainly relies on road-waterway intermodal transportation and waterway-waterway connection, and sea-rail intermodal transportation has not been able to develop as expected for a long time. In 2019, container transportation accounted for only 3% of China's railway freight volume, while railways accounted for only 1% of the national port container collection and transportation (Zhuang, 2021). This includes both the influence of the railway transportation system and mechanism, as well as the problem of the port abandoning its efforts to cooperate with the railway to a certain extent, such as some even dismantling the existing railway in the port area. Container multimodal operation is an advanced form of transportation organization, which needs to give full play to the inherent advantages of different modes of transportation on the chain to achieve the integrity and high efficiency of transportation products, and form a seamless freight and logistics system as much as possible through organizational change. The substantial improvement of port efficiency is the real starting point and key for container multimodal transportation to be successful, and the sea-rail intermodal transportation chain will inevitably require the port with a relatively high level of service to be in a dominant position, and other transportation entities, including railways, should cooperate with and obey the port's operating process and work rhythm.

#### *3.4. Explore Diversified Financing Methods to Support the Development of Comprehensive Transportation*

To build a comprehensive transportation system, from the perspective of current

development status and social needs, expanding the scale of transportation investment and improving the supply capacity of transportation are the main directions at present. The unique nature of transportation infrastructure (basic, quasi-public, external) determines that government investment is still the main source of funds for the construction of transportation infrastructure such as railways, highways, civil aviation, water transportation, and pipelines. At present, the funds for the construction of railways, highways, civil aviation, water transport, and pipelines mainly come from government investment, but in the face of the huge demand for tens of billions of transportation construction funds that continue to increase, the proportion of government investment funds is getting smaller and smaller. For example, in the construction of highway infrastructure, rural road projects and road network reconstruction projects are mainly invested by the government, but of the funding sources for highway and secondary highway projects, government investment only accounts for a part. Most of the sources of funding need to be raised for the society. Exploring diversified financing policies and expanding the scale of financing to meet the needs of large-scale transportation infrastructure construction are important conditions for building a comprehensive transportation system (Wang, 2020).

At present, the management of funds must have new ideas and new measures. It is recommended to coordinate the special taxes and funds in the field of transportation and establish a comprehensive transportation development fund to better promote the integration of various modes of transportation and ensure the sustainable development of the transportation industry. We should pay attention to the role of the market, further promote the application of the public-private partnership (PPP) model, and effectively provide the policy guarantee for social capital to enter the field of infrastructure construction. In general, in accordance with the requirements of high-quality development, we will focus on reforming the investment and financing system and mechanism of transportation infrastructure, establish and improve the investment and financing management system which is “government-led, level-to-level responsibility, diversified financing, standardized and efficient”, build a virtuous cycle mechanism of investment, financing, construction, operation and debt repayment, and promote the sustained and healthy development of transportation (Ma, 2019). According to the nature and income of transportation infrastructure projects, it is necessary to explore new investment and financing mechanisms and new models suitable for transportation infrastructure at different levels, in different regions, and in different features, broaden the sources of funds for investment projects, fully tap the potential of social funds, and effectively alleviate the problem of difficult and expensive financing. It is necessary to make use of the extensive application of “Internet + big data” in the field of transportation, increase the intensity of the declaration and inclusion of transportation infrastructure projects in the online approval and supervision platform for investment projects, and realize one-window acceptance, parallel processing, standardized transparency, and time-limited completion (Zhang, 2021).

At the same time, it is necessary to strictly control the risk of transportation debt. All localities and relevant departments should further improve the system design, improve the management methods for government debt in the construction of transportation infrastructure, consolidate the institutional foundation, accelerate the construction of an internal control system covering all aspects of fund raising, budget preparation, budget implementation, asset management, audit supervision, and so on, and strengthen the construction of an early warning and prejudgment mechanism for government debt in the transportation field. We should make overall use of all kinds of funds for transportation construction, and research on the establishment of a debt repayment reserve system. It is necessary to strictly standardize the procedures for borrowing and repaying debts, ensure reasonable borrowing, repayment of debts on demand, and orderly repayment of loans, and put an end to the emergence of problems such as illegal guarantees, explicit shares but real debts, irregular management and use, and idle funds. The government should strengthen the standardized management of financing platforms, cooperation between the government and social capital, and government procurement of services, and resolutely stop borrowing in violation of the law. We should make full use of national policy resources and various funds, bonds, and other resources to further optimize the debt structure and alleviate the pressure on loan repayment. We should strengthen the management of government investment projects, clarify construction standards and construction periods, issue investment plans in strict accordance with the progress of project construction, strictly compile the accounts of estimate, budget, settlement and final accounts, put an end to over-scale, over-standard, and over-estimated budgets, and ensure that government investment can give play to its benefits in a timely manner. It is necessary to strictly control the construction and management costs, implement the supervision of the whole process of auditing, and ensure the safety of the use of funds. Through multimodal and all-round effective prevention, we must ensure that regional and systemic government debt risks do not occur in the field of transportation infrastructure construction (Dong, 2019).

### *3.5. Promote Collaborative Innovation in Transportation Technology and Improve Transportation Technology Support Policies*

Scientific and technological progress is driving the construction of a comprehensive transportation system more and more. As a long-term strategy for building a comprehensive transportation system, the strategy of “developing transportation through science and education” must always be upheld and implemented in depth. The research and development of comprehensive transportation system construction technology must obtain the participation and attention of the government and all transportation groups at home and abroad, and many members of society. It is necessary to actively introduce comprehensive technical support policies, speed up the technological progress

of transportation, further popularize and apply new technologies, new materials, new processes, and new methods at home and abroad in key areas of transportation development, raise the level of construction of transportation infrastructure and the level of production and manufacturing of means of transportation, and promote the construction of a comprehensive transportation system. In particular, we should pay attention to the construction of transportation informatization, and regard scientific and technological innovation and informatization construction as the central link to accelerate the transformation of the mode of transportation development (Wang and Gao, 2019). Efforts can be made in the following aspects.

First, make breakthroughs in comprehensive transportation system and safety technologies, and core technologies for major transportation infrastructure. At present, the independent innovation ability of China's comprehensive transportation system is not strong, the problem of bottlenecks of key core technologies is prominent, and the vitality and motivation for the development of transportation innovation are still insufficient. The key core technology is the main problem affecting the competitiveness of China's comprehensive transportation industry. At present, the key core technology of comprehensive transportation products in China's market relies on imports. This is true even the fast-growing, widely promoted and widely popularized intelligent navigation industry and intelligent transportation industry. For example, in the intelligent navigation industry, professional measurement receivers and direction finding receiver products, foreign chips account for a relatively high proportion, and domestic chips are insufficient. In terms of intelligent transportation industry, key equipment and technologies are also dependent on imports. The lack of key core technologies not only makes the industry continue to pay expensive technology use costs in the process of development, but also the lifeline of the industry will be strangled by foreign enterprises. In view of this, it is necessary to take scientific and technological innovation as the guide, study and deploy the medium- and long-term strategy of transportation science and technology innovation, focus on solving the problem of key core technology bottlenecks, and accelerate the research and promotion and application of new technologies (Cai, 2021).

Second, promote the intelligentization and greening of the comprehensive transportation industry, and lead the development of the future transportation industry with intelligence and green. Artificial intelligence, big data, quantum information, biotechnology and other new rounds of scientific and technological revolution and industrial revolution have given new momentum to the development of comprehensive transportation. Using intelligent management as a means, we will promote the digitization, networking and operation intelligence of transportation infrastructure and means of delivery to improve transportation efficiency and reduce operating costs (Wu and Wei, 2020). Focusing on improving the intelligent level of intercity transportation travel, we should accelerate the intelligent development of urban traffic, and promote

the construction of a smart transportation information service system with enterprises as the entities. By encouraging the development of “Internet +” to facilitating the development of transportation, including urban rail transit, urban highways and urban road traffic and other different landing scenario technologies, more opportunities will be provided to promote China’s intelligent transportation development. The future of intelligent transportation will be extended to the sea and aviation. At the same time, intelligent coordination and services of comprehensive transportation, intelligent guarantee of safe operation transportation system, cooperative intelligent transportation and automatic driving will become the focus, but attention should also be paid to avoiding the emergence of social and economic problems after the investment in intelligent transportation development (Wu *et al.*, 2019). Difficulties in sharing and insufficient development and utilization of information resources are the basic problems that restrict China’s development for a long time, and we must take practical measures to break down information barriers, open information islands, and promote the sharing and opening of information resources. In addition, it is necessary to make full use of information technology, innovate business models, optimize business processes, standardize management behavior, and avoid the disconnections between information technology and transportation business.

Third, it is necessary to strengthen the ability to introduce, absorb and re-innovate comprehensive transportation advanced technology. Although some achievements have been made in the introduction, absorption and re-innovation of China’s comprehensive transportation advanced technology, the rail transportation equipment manufacturing industry has become one of the few successful examples in China that has realized industrialization and internationalization in this respect, in the face of the major needs of the transformation and development of China’s comprehensive transportation system in the new period, there are still many bottlenecks and problems in the introduction, absorption and re-innovation of advanced technology in the comprehensive transportation system. For example, the phenomenon of “emphasizing hardware, neglecting software, emphasizing introduction, neglecting absorption and re-innovation” in the introduction of technology is relatively common, the introduction, absorption and re-innovation has not yet formed a complete chain, the policy environment for the introduction, absorption and re-innovation has yet to be optimized, and the ability of local enterprises to introduce, absorb, and re-innovate needs to be improved, as well as the need to increase investment in the introduction, absorption and re-innovation (Wuhan University Open Innovation Research Group, 2019).

### *3.6. Excavate the Value of Transportation Data and Give Play to the Role of Big Data in Promoting the comprehensive Transportation System*

With the development of social productivity and the continuous improvement of

the income level of urban and rural residents, people's travel patterns have undergone tremendous changes, and while enjoying the convenience brought by science and technology, people are also suffering from traffic congestion. With the development of the internet of things and intelligent terminal technology, the accumulation and growth of data in various industries are rapid, the value of traffic data has been paid more and more attention, and we must give full play to the role of big data in promoting the comprehensive transportation system (Liu, 2020). It is necessary to promote the open sharing of government comprehensive transportation data, optimize the basic database of economic governance, accelerate the sharing and exchange of data among transportation departments in various regions, and strive to promote data exchange with other relevant departments. The government should introduce the responsibility list of comprehensive transportation data sharing. Through the open sharing of information and data by various modes of transportation, we will strengthen the integration of various modes of transportation and transportation services, and promote the construction of a comprehensive transportation system. We should build a comprehensive transportation public information service platform and transportation big data center in high level, fully integrate transportation data resources, develop and provide rich data products, and improve service levels.

It is necessary to actively explore the value of data resources of relevant enterprises, cultivate new industries, new formats and new models of the digital economy, and support the construction of scenarios for standardized data development and utilization in the fields of comprehensive transportation and other public resources. We should give full play to the role of industry associations and chambers of commerce, and promote the standardization of data collection in the fields of artificial intelligence, wearable devices, internet of vehicles, and internet of things. In the era of artificial intelligence and large data, it is extremely important to strengthen the integration and security protection of data resources, and it is necessary to explore the establishment of a unified and standardized data management system, improve data quality and standardization, and enrich data products. The government should promote the confirmation of relevant data property rights based on comprehensive transportation-related data sources, formulate data privacy protection systems and security review systems, promote the improvement of data classification and gradation security protection systems suitable for big data environments, and strengthen the protection of government affairs data, enterprise commercial secrets and personal data.

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