An Analysis of the Role of Smart Transportation in Economic Development under the Background of Big Data

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Abstract. Transportation still faces problems such as insufficient system coordination, uneven infrastructure configuration, and imperfect service systems. The application of big data technology has improved the intelligence level of transportation, provided strong support for management and decision-making, and promoted the development of smart transportation. Smart transit plays a crucial role in economic development in the era of big data.

Keywords: smart transportation, big data, transportation economy

1 Introduction

The report of the 20th National Congress of the Communist Party of China emphasizes the need to accelerate the construction of a strong transportation country. Transportation is crucial for economic and social development and is vital for building a new development pattern. The development of transportation is required to continue as a pioneer to achieve the second centenary goal. The outlined plans focus on improving transportation quality and promoting reasonable growth, making transportation a leading force in the future.

In recent years, innovative concepts based on new technological means such as smart transportation have emerged in the transportation industry, including road transportation. The introduction of big data technology has brought new vitality and innovative thinking to the highway transportation industry, greatly expanding its development possibilities. Relying on the diversified and complex application of Internet, artificial intelligence, blockchain, Beidou navigation and other technologies, the deep integration of intelligent transportation and digital economy will give greater play to the value of data elements, become a new growth pole of digital economy development, and bring

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about a more significant multiplier effect of national economic growth. Given the increasing importance of regional economic development and construction, as well as the growing impact of big data on various industries, a deep understanding of the role and current situation of highway transportation in the process of regional economic construction under the background of big data will be of great value and significance for better understanding and playing the role of highway transportation in promoting economic development.

2 Literature Review

The development of smart transportation benefits from the development of science and technology. Hamidi and Kamankesh (2018) pointed out that intelligent traffic management is one of the most promising solutions to today's transportation problems[1]. Li et al. (2017) proposed a hierarchical operational framework for effectively and flexibly adjusting traffic signals under dynamic traffic conditions based on smart transportation[2]. Osman et al. (2017) utilized the concept of intelligent transportation to design a dynamically managed transportation system that replaces traditional fixed time-based transportation systems[3].

Transportation is an effective measure to promote socio-economic development, and its economic benefits analysis has gradually become a research hotspot. Qiang et al. (2022) conducted a quantitative study on the coupling coordination status and spatial distribution characteristics of economy and transportation in 30 provinces of China[4]. Almeida et al. (2021) established a theoretical model to explain the relationship between transportation infrastructure and economic development[5]. Weizheng (2021) selected data from 31 provinces and used fixed effects models and moderating effects methods to study the impact of transportation infrastructure on economic growth[6].

3 The Problems of Transportation in economic Development

3.1 The Transportation System Lacks Comprehensive Coordination Capabilities

The benefit of creating a comprehensive transportation model is to maximize value by improving regional transportation efficiency. However, there are currently challenges such as insufficient coordination capabilities and immature management systems in the transportation system. These issues lead to problems like low management efficiency, high construction costs, and incomplete infrastructure, resulting in wasted resources and increased time and cost of highway transportation.

3.2 Uneven Allocation of Transportation Infrastructure

Due to the imbalance of regional economic development, there is still an unequal distribution of transportation infrastructure in China. This gap is expected to widen further. The imbalance has led to situations where transportation capacity exceeds demand in some regions, while in others, demand exceeds capacity. This inefficient allocation of resources has resulted in unnecessary waste. Developed regions often have excessive transportation infrastructure, leading to underutilization of existing facilities. Conversely, underdeveloped areas have inadequate transportation infrastructure, hindering their ability to support regional economic development.

3.3 The Transportation Service System Needs to Be Improved

The quality of transportation services is closely related to the service personnel and system. Professionals with high expertise can provide efficient services to meet the transportation needs of different regions. However, there are significant deficiencies in service capabilities and comprehensive quality in China's transportation industry. Introducing information technology, including big data, is necessary to provide new solutions for transportation service systems.

4 The Development Trends of Transportation under the Background of Big Data

Big data technology has enabled the collection of massive amounts of transportation operation data. Effectively analyzing and processing this data through big data technology will result in a more targeted and intelligent transportation management system. The market size of China's smart transportation industry in recent years is shown in Fig. 1. It can be seen from the figure that China's smart transportation industry is in a sustained development trend. In the past six years, the market size of China's smart transportation industry has increased by about 2.5 times, with an annual growth rate of around 15%. Since 2020, the growth rate has risen to 20%.

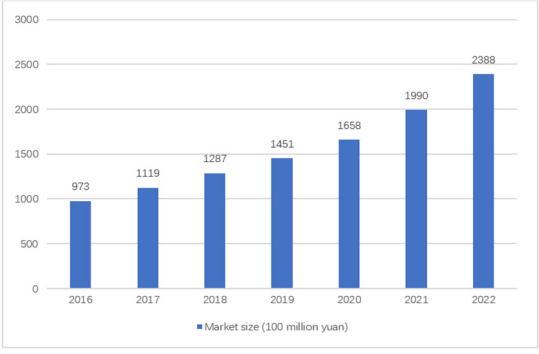

Fig. 1. Market size of smart transportation industry

4.1 Realizing Precise Detection of Transportation Data

Big data technology can be used for effective management of traffic data during transportation processes to identify traffic data generated during transportation lanes. As more and more regions begin to integrate big data technology with existing traffic supervision hardware, in order to better detect real-time road and transportation conditions, and achieve precise control of transportation conditions. At the same time, by collecting traffic flow and traffic condition data from existing road monitoring equipment and importing big data technology, relevant traffic management units can better assist them in formulating evacuation and traffic control measures and plans more systematically and timely through precise and scientific analysis of transportation data, achieving timely warning and effective diversion of traffic problems.

4.2 Real-Time Tracking of Transportation Subject Location Data

Big data technology is used to manage traffic data and identify traffic patterns during transportation processes. It helps in detecting real-time road and transportation conditions and enables precise control. By collecting traffic flow and condition data from existing road monitoring equipment and using big data technology, relevant traffic management units can better assist in formulating evacuation and traffic control measures through precise and scientific analysis.

4.3 Building an Intelligent Transportation Analysis System Based on Big Data Foundation

When managing transportation, video image data is an important component of transportation data. Therefore, building an intelligent transportation analysis system based on big data can be used to predict, analyze, and evaluate the operation of different transportation vehicles or modes, prevent safety accidents, and improve transportation efficiency. At the same time, the deep application of big data technology in transportation management can also help relevant management departments and personnel to accurately and quickly obtain core data from massive transportation data, fully utilize data such as traffic flow and transportation personnel behavior characteristics, and better assist transportation planning departments to achieve continuous optimization and transformation of corresponding engineering solutions.

5 Analysis of the Role of Smart Transportation Based on Big Data in Economic Development

Compared to traditional transportation industry, smart transportation based on big data not only has the promoting effect of traditional transportation on economic development, but also has greater potential and advantages in optimizing resource allocation, improving safety level, promoting environmental protection and sustainable development, and driving the development of upstream and downstream industries. The

specific path for transportation to overcome economic bottlenecks and obstacles stems from the following four basic links of economic activity.

In the production process, transportation development significantly influences production factor allocation and industrial structure layout. Through logistics systems, transportation facilitates the efficient movement of raw materials, components, and finished products between different locations, promoting the spatial circulation of factors and bringing about changes in industrial structure.

During the allocation process, transportation directly impacts product sales networks and industry market share. Through logistics networks and supply chain management, transportation reduces spatial and temporal distances and transportation costs between production and consumption areas. This enables the swift and safe distribution of products and services to various markets and consumers, accelerating economic agglomeration and promoting industrial transformation.

In the exchange process, transportation plays a vital role in optimizing resource allocation and coordinating industry development. Through material transportation channels and information flow platforms, transportation fosters communication and cooperation between different regions, enterprises, and individuals, opening up regional markets and fostering economies of scale.

In the consumption process, transportation indirectly influences consumer behavioral structure and industrial structure adjustment. A comprehensive transportation network and supporting facilities enable consumers and the market to obtain products and services safely and conveniently, thereby optimizing consumer decision-making and improving the industry's market size.

6 Conclusion and Recommendation

Against the backdrop of building a strong transportation country, China's regional economic development has achieved rapid growth driven by the development of smart transportation. Big data technology, as a key means of information technology and a form of promoting economic development in the new era, is also widely applied in the smart transportation industry. In order to better leverage the positive role of smart transportation in economic development and promote the development of transportation economy, it is necessary to fully analyze the regional economic development needs and the current situation of the smart transportation industry, and effectively utilize big data technology to promote economic development in the process of improving the informatization and intelligence of transportation systems. Strengthening the construction of informatization and intelligence is essential to maximize the positive impact on economic growth.

Firstly, build an intelligent traffic management system that utilizes technologies such as the Internet of Things, artificial intelligence, and big data analysis to achieve real-time monitoring of traffic flow and vehicle location, thereby improving the efficiency and response speed of traffic management. Secondly, developing intelligent driving technology and promoting research and application of autonomous driving technology to improve traffic safety and efficiency. Thirdly, strengthen data sharing and openness,

promote data sharing between different departments, break down information silos, and establish unified data standards and interfaces. Finally, intelligent traffic monitoring devices will be introduced to monitor road conditions, traffic violations, and accidents in real-time through the installation of high-definition cameras, sensors, and other devices. This can not only improve the level of traffic management, but also strengthen traffic safety supervision and respond to various emergencies in a timely manner. The above measures can strengthen transportation coordination, solve the problem of imbalanced distribution within the structure, improve service systems, and utilize the potential of intelligent transportation through big data to achieve resource optimization, safety improvement, environmental protection, and sustainable development.

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