

Research on Speeding up the Promotion of Scientific Big Data Center of Waterway Transportation under the Background of "New Infrastructure Construction"

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Abstract: With the economy entering the "new normal", China's waterway transportation industry has entered a critical period of transformation and upgrading. Meanwhile, the construction of a safe, convenient, efficient and green modern comprehensive transportation system also puts forward higher requirements for the knowledge value of waterway transportation scientific data. At present, the development of waterway transportation industry urgently needs to use big data thinking to systematically study the collection, management, mining and application of scientific data, so as to build industry scientific big data center based on relatively complete ecological industrial chain, which is used to support the improvement of industry scientific and technological innovation ability and the construction of a new chapter of water transportation science and technology in Powerful Transportation Nation Construction. On the basis of in-depth analysis of the status quo and significance, this paper put forward suggestions on the construction of water transportation scientific big data center and its related system from the aspects of platform construction, policy standard formulation, core technology breakthrough, and ecological industry chain establishment.

1. Development Status of Scientific Big Data of Waterway Transportation in China

With the collaborative promotion of the novel coronavirus pneumonia control and socio-economic development, the new infrastructure construction that is vigorously promoted by science and technology has become a hot topic. On March 5, 2020, General Secretary Xi Jinping pointed out at the Standing Committee of the Political Bureau of the Central Committee, "speed up the construction of new infrastructure such as 5G network and data center". This is the first time in recent years that the data center has been included in the item of accelerating the construction of

"new infrastructure". As a bright spot in the "new infrastructure", the data center has attracted great attention from the industry[1]. As an important part of the comprehensive transportation system, waterway transportation has the comparative advantages of large transport capacity, small land occupation, low energy consumption, light pollution and low cost, and is an important basic industry for economic and social development[2]. With the development of economic and social and the improvement of development concept, the position and role of waterway transportation in the comprehensive transportation system has become increasingly prominent, and has become a strategic force leading the economic and social development. With the economy entering the "new normal", China's waterway transportation industry has entered a critical period of transformation and upgrading. The construction of a safe, convenient, efficient green and modern comprehensive transportation system also puts forward higher requirements for the knowledge value of scientific data of waterway transportation. At present, the development of waterway transportation industry urgently needs to use big data thinking to systematically study the collection, management, mining and application of scientific data, so as to build industry scientific big data center based on relatively complete ecological industrial chain, which is used to support the improvement of industry scientific and technological innovation ability and the construction of a new chapter of water transportation science and technology in the construction of Powerful Transportation Nation.

1.1. Development Basis of Scientific Big Data of Waterway Transportation

The waterway transportation industry has an endogenous environment and soil for big data research and application, and the industry itself has always been fusion and symbiosis with big data research.

1.1.1. Abundant Data Sources

Abundant data sources provide basic conditions for the research and innovative application of waterway transportation big data. The data from the prototype observation and mathematical model calculation of coastal and inland rivers[3], the operation monitoring of major waterway transport infrastructure[4], the monitoring of environmental protection and safe operation of waterway transportation engineering, the analysis and evaluation of hydraulic structures, etc., play an important supporting role in the planning, construction, maintenance and management of waterway transportation.

1.1.2. Huge Value of Industry Data

The characteristics of the industry determine that the waterway transportation industry generates a large amount of data all the time, which promotes the accumulation and precipitation of industry big data. And the huge benefits hidden behind the data are gradually highlighted in the accumulated small progress. Taking inland waterway perception and long-term performance monitoring of port facilities as an example, the application of accumulated data for many years plays a key role in the scientific maintenance process of waterway and port facilities[5].

1.1.3. Multidimensional Application of Data Promoted by New Technology

The development and application of new technologies such as internet of things, cloud computing and big data also drive the innovation and application of big data in the waterway transportation industry[6]. The technology of internet of things makes it possible for long-term real-time monitoring of waterway transportation infrastructure, which has also become one of the most important sources of industry big data. The popularity of cloud computing technology greatly improves the computational efficiency of numerical simulation of waterway transportation

engineering. The application of big data mining technology to the monitoring data association analysis solves the problem of unsystematic analysis caused by the single data source under traditional detection methods.

1.1.4. Development Direction Led by New Trend

At present, the industry's high-quality development requirements and the major layout of the "new infrastructure construction" provide an important follow-up for the research and application of scientific big data in waterway transportation, including the formulation and revision of big data standards and regulations, research on the technology of big data acquisition, storage, processing, analysis and mining, deep integration and application of big data in multiple fields, big data sharing and exchange and related products value added services, etc.

1.2. Development Status of Scientific Big Data of Foreign Waterway Transportation

At present, the total number of data centers in the world is about 3.5 million, with the United States and Europe accounting for almost half of the global total. The United States, the European Union and Australia jointly launched and established the Research Data Alliance (RDA) in 2012, strengthening their discourse power and monopoly position in the field of global data standardization and innovative application[7]. With their own advanced management system, perfect traffic management facilities and early information network technology, western developed countries have accumulated a large amount of data in the past transportation management, especially in the field of waterway transportation. They developed a variety of models and systems accordingly, making their information research and application in the international leading level for a long time. For example, Rotterdam port in the Netherlands, together with several ports and transportation companies, has jointly developed the port centered International Transportation Information System (INTIS), which integrates and automatically processes massive port information data, improves the efficiency of port operation and management, and ensures that Rotterdam port maintains its position as the largest port in Europe for a long time.

1.3. Development Weakness of Scientific Big Data in Waterway Transportation

1.3.1. The Quality of Data Collection Needs to be Improved

The scientific data sources of waterway transportation include the basic and applied research of waterway transportation, major engineering projects, and the original and derivative data formed by observation, monitoring, investigation and inspection.

Due to the diversity of data sources, and most of them are temporary and phased collection, rather than business continuous operation, as well as the data collection methods, equipment, standards, personnel, and channels are not unified, it will bring difficulties to the data aggregation to a certain extent. The quality of data without special processing, cleaning or integration cannot be guaranteed, and the data availability and application value are greatly reduced.

1.3.2. The Data Research Lacks the Support of Conditions

In recent years, the transportation industry has promoted the development of intelligent transportation with big data as an important driving force, and a number of big data laboratories have been built. However, for the waterway transportation industry, which needs more data generation and application, the relevant big data experimental conditions and platforms have not been laid out. Especially in the field of waterway transportation engineering with infrastructure as

the key research object, it does not have the basic conditions to carry out the research on big data and professional integration technology, nor does it have the necessary laboratory and experimental equipment for big data application research in the industry.

1.3.3. The Mining of Data Application Value is Not Enough

At present, a large number of precious scientific data of waterway transportation are only one-time services for a project, and the ability to carry out systematic analysis and research by using emerging information technology such as big data and parallel computing has not been fully formed, which leads to the lack of data value-added services and products, and the lack of research achievements with core competitiveness and independent intellectual property rights based on the scientific data of waterway transportation. The lack of data development and utilization and value mining has caused huge data waste and reduced the enthusiasm of data acquisition and analysis personnel, which in turn restricted the acquisition of data.

1.3.4. The Data Standard Risk Management is Not Perfect

In 2018, the State Council issued the Management Measures for Scientific Data. However, the Ministry of Transport has not yet issued the scientific data management rules and related technical standards and systems specifically for the industry. Scientific research institutes, universities, enterprises and other legal entities related to the waterway transportation industry are the responsible subjects of scientific data management. However, there are still some problems in scientific data management of all parties, such as no standard for data collection, unconditional availability of data storage, no rule guarantee for data security, no responsibility for implementation of data management, and serious waste of data resources, etc. In addition, due to the disorder of management, some data related to national public security or national key core technology will also have the risk of loss and leakage.

2. Significance of Building Scientific Big Data Center of Waterway Transportation

Data center is the place for data computing, storage and interaction, and it is the general supporting technology in the fields of internet, cloud computing and artificial intelligence. It is also the concentrated embodiment of the underlying infrastructure of intelligent economy and the new connotation of national competitiveness. Accelerating the construction of scientific big data center is of great significance to the high-quality development of waterway transportation industry.

2.1. Providing a New Impetus for the Steady Growth of Social Economy in the New Historical Period

In the medium and long term, the industrial infrastructure in the field of digital economy such as data center should be appropriately advanced in layout when technology and funds permit, so as to give full play to the role of big data innovation in serving the development of the industry and prospering the application market. In particular, under the macro background of the intensified competition in science and technology among major countries and the acceleration of the construction of the Powerful Transportation Nation, increasing investment in industry data center will help stabilize growth and employment, release the potential of domestic economic growth, and provide new impetus for industrial digital transformation and upgrading and high-quality development of the industry, effectively alleviate the novel coronavirus pneumonia impact on the national economy and transportation industry, and accelerate the narrowing of the digital divide in the related fields of developed countries.

2.2. Providing a New Path for Industrial Transformation and Upgrading Under the New Development Situation

At present, China's economy has entered the "new normal", and the waterway transportation industry is also developing from large-scale construction to the whole chain of "construction, management, maintenance and utilization". In the critical period of structural reform, the industry urgently needs to fully integrate modern information intelligent technology to improve the highly intensive industry data center and other basic support environment, and incorporate them into the waterway transportation infrastructure system[8]. On the basis of effective management and scientific application of industry data, the endogenous power and potential value of data as an important strategic resource are explored to provide support for waterway transportation planning and design, engineering construction, scientific research, detection and evaluation, and promote the transformation and development of waterway transportation engineering industry.

2.3. Providing a New Mechanism to Support the Government's Scientific Decision-making under the New Demand Supply

The waterway transportation industry involves professional fields such as ports, waterways, ships and shorelines, as well as the management departments of port and shipping, maritime affairs, environmental protection and water conservancy, as well as many industrial enterprises. Its development cannot be separated from the business collaboration across regions, cross fields, cross systems and cross countries, as well as the accurate support of related data [9]. In order to effectively improve the systematicness and scientificity of government decision-making, it is urgent to establish a unified data sharing platform and mechanism, and form a scientific big data center with perfect data resource management ability, so as to break through the "data island" and "data link break point" between the government, enterprises and the public. The new thinking of big data provides a new data supply mechanism for relevant management decision-making and scientific research.

2.4. Providing a New Opportunity for Scientific Innovation Research of Waterway Transportation under the New Technology Conditions

At present, a new round of scientific and technological revolution is in the ascendant, and a batch of new technologies represented by big data, internet of things, cloud computing, etc., are constantly emerging, which promotes profound changes in the industry[10]. In the big data center of waterway transportation science, the error of human subjective factors can be eliminated through massive data input, high-performance calculation and correlation analysis of multi-source data. The integration and innovation of big data technology and traditional waterway transportation specialty, and gathering industry data, are the needs of waterway transportation scientific research to actively adapt to the direction transformation, means upgrading and level upgrading under the new technology conditions, and is also an important way to promote a new round of high-speed development of scientific research and innovation and support the scientific and technological development of transportation power.

3. Countermeasures and Suggestions on Promoting the Construction of Scientific Big Data Center of Waterway Transportation

3.1. Construction of National Scientific Big Data Center of Waterway Transportation

Based on the trend of big data technology and the development needs of the waterway transportation industry, a national water transport scientific big data center and a basic platform would be built for the cross-border application of industry big data, so as to promote cross sectoral and cross regional data sharing and business collaboration, and fill in the gap in the research field of big data in China's waterway transportation field. Through the intelligent operation and maintenance of the data center, a sustainable collaborative innovation mechanism of government, industry, university, research and application is established, which provides experimental conditions for the basic research and application research of industrial scientific big data, provides innovative support for the cultivation of compound talents of big data technology and waterway transportation, and provides scientific basis for scientific and accurate implementation of industrial management departments.

3.2. Formulation Industry Big Data Management Methods and Standards

According to the Measures for the Management of Scientific Data issued by the State Council, and in combination with the characteristics of the waterway transportation industry, it is suggested to formulate specific industrial scientific big data management rules. By improving the top-level policy design, the division of labor and responsibility system of administrative departments at all levels and relevant units should be clarified, so as to further standardize scientific data management, ensure the safety of scientific data, and improve the level of openness and sharing. It is suggested to promote the overall planning and planning of data at the industry level, organize research and formulate management policies and standards for classification and classification, collection and production, processing and sorting, long-term preservation, open sharing, evaluation and assessment of industry scientific big data, so as to ensure data quality and value output.

3.3. Research and Development a Series of Key Core technologies of Industry Big Data

In view of the deep-seated, strong correlation and multi-dimensional analysis requirements and technical bottlenecks of the current massive multi-source heterogeneous data processing and analysis, it is suggested to focus on big data, cloud computing, internet of things, artificial intelligence, machine learning, 5G and other forward-looking technologies, and focus on the development of technology policy theory, collection and aggregation technology, storage and management technology, and analysis of mining technology, security sharing technology of scientific big data of waterway transportation. Through the deep processing of massive structured information and unstructured information, the supply capacity of forward-looking and guiding key core technologies, such as collaborative acquisition of scientific data, integrated management, multi domain and multi-dimensional information reconstruction and visual computing, is further strengthened.

3.4. Establishment of an Ecological Industry Chain of Scientific Big Data application in waterway Transportation

Guided by the construction of digital waterway transportation, it promotes the deep integration of big data with traditional specialties such as hydraulic engineering, port and shipping, etc., promotes the enrichment of ecological industrial chain with big data sharing and exchange and value-added services of related products, and promotes diversified demonstration and application scenario construction of up-down linkage, so as to provide decision-making basis for the planning and construction, operation management, maintenance, green environmental protection, safety emergency of waterway transportation, and smart port building, intelligent shipping construction, waterway transportation economic development, provide tools and means for industry macro and micro data analysis, strengthen the platform's ability to serve economic and social development, and provide support for intelligent economic development and industrial digital transformation.

4. Conclusion

Under the background of the current economic "new normal", "new infrastructure construction" accelerated layout and the construction of Powerful Transportation Nation, speeding up the construction of scientific big data center can provide a new impetus for the steady growth of social economy in the new historical period, a new path for industrial transformation and upgrading under the new development situation, a new mechanism to support the government's scientific decision-making under the new demand supply, a new opportunity for scientific innovation research of waterway transportation under the new technology conditions. In the next step, it is suggested to make up for the shortcomings in the aspects of the construction of national scientific big data center of waterway transportation, the formulation of industry big data management methods and standards, the research and development of a series of key core technologies of industry big data, and the establishment of an ecological industry chain of scientific big data application in waterway transportation, so as to improve the system and inject powerful new momentum into the construction of a new chapter of water transportation science and technology in the construction of Powerful Transportation Nation.

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