A Study on Optimization of Statistical Indicator System for Railway Container Logistics Business

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Abstract. In order to improve the statistical system of China's railway container transportation and improve the capacity and level of railway container logistics services, higher requirements have been put forward for the statistical work of railway container transportation. On the basis of analyzing the statistical business requirements of railway container logistics, the basic ideas for evaluating railway container logistics business are proposed, with a focus on elaborating the calculation methods and basic content of railway container logistics business evaluation. On the basis of a comprehensive analysis of the evaluation requirements for railway container logistics business, a framework of evaluation indicators for railway container logistics business was established for the entire process service content. The main evaluation indicators were explained and calculation methods were explained. Finally, taking the evaluation of the operational quality of railway container business as an example, the application of evaluation methods for railway container logistics business is optimized and designed. This study provides decision-making basis for the evaluation and management of railway container logistics operation.

Keywords: Railway, Container Logistics, Statistical Indicator System

1 INTRODUCTION

At present, the statistical indicator system for railway transportation statistics in China is relatively sound, and the statistical methods are relatively mature, and have achieved good statistical results [1-4]. However, with the development of new railway logistics business, the data statistics work on various new logistics businesses is still in its infancy, and the statistical indicator system and statistical methods are still being explored and studied [5-6]. With the launch and development of new railway logistics services, railway freight has transformed from traditional "station to station" transportation to "door to door" transportation, expanding from simple mainline transportation services to comprehensive logistics services that integrate warehousing, distribution, packaging, circulation processing, information services, etc. This requires the construction of a modern logistics statistics system that is suitable for it. However, China's existing railway transportation statistics and clearing system mainly focuses on passenger transportation, freight transportation, vehicle and locomotive operation,

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covering all aspects of railway transportation business such as traffic volume, turnover, vehicles, and locomotives. However, there is a lack of statistical standards that are suitable for the new type of railway modern logistics business, and the existing statistical system is also disconnected from the needs of railway logistics management. The prominent manifestations are incomplete collection of basic data, weak correlation between basic data and business operations, and incomplete statistical indicator system for business operation evaluation, which makes it difficult to accurately and comprehensively reflect the operational status and management level of modern railway logistics systems.In summary, the development trend of railway modern logistics business has put forward requirements for studying railway modern logistics statistical methods, researching railway logistics basic data collection technology, constructing a railway logistics business evaluation index system for the entire process, forming statistical index calculation methods, and designing a railway logistics business operation evaluation system.

The development of railway container logistics business is an important link in the development of modern logistics markets for railway transportation enterprises. It plays an undeniable role in strengthening the traditional competitiveness of railway transportation enterprises and their competitiveness in emerging logistics markets [7-9]. In the increasingly thriving modern logistics management, the role of statistics is becoming increasingly evident[10]. From the perspective of statistical surveys, railway container logistics statistical indicators, and container logistics statistical data analysis methods, continuous improvement and improvement should be made to meet the actual needs of railway logistics statistics . At the same time, in order to more effectively leverage the role of railway container logistics statistics, linking the analysis results of railway container logistics statistical data with the operational situation of railway container logistics business, reflecting the effectiveness and existing problems of railway container logistics business operation, and guiding the improvement direction of business operation, is the core goal of railway container logistics statistical research. Therefore, in response to the current issue of disconnection between the collection and analysis of railway container logistics data and the needs of railway container logistics business, this study combines the development situation and future development trends of railway container logistics business, analyzes the statistical needs of railway container logistics business, and establishes a comprehensive evaluation index system and calculation method for railway container logistics business. The design scheme of the railway container logistics business operation evaluation system has been proposed, hoping that this study will provide auxiliary decision-making support for the operation and management of railway container logistics business.

2 Design of Statistical Indicator System for Railway Container Business

2.1 Analysis of statistical requirements for container business

The railway container transportation business is uniformly managed by China National Railway Group Co., Ltd., and operated in collaboration with China Railway Bureau Group Co., Ltd. and China Railway Container Transport Co., Ltd. Each container handling station is responsible for the specific implementation of the business. Specifically, China National Railway Group Co., Ltd. is responsible for the organization and unified management of container transportation along the entire route; The railway bureau is responsible for organizing and managing container transportation within its jurisdiction; China Railway Container Transport Co., Ltd. (hereinafter referred to as the container company) is responsible for asset management work such as purchasing, leasing, repairing, and scrapping railway containers; Container handling stations (including railway dedicated lines and dedicated railways for container transportation) are stations responsible for handling container transportation business, and containers are transported between container handling stations.

In the process of carrying out railway container business, the railway bureau should fully leverage the advantages of high container standardization, fast loading and unloading operations, good cargo safety, and convenience for multimodal transportation, prioritize the development of container transportation, and increase the proportion of container transportation. We should also promote container transportation to meet market needs, develop rail water intermodal transportation and international intermodal transportation, develop express freight trains, and increase the proportion of train volume. At the same time, it is necessary to strengthen the construction of pick-up and delivery capabilities, vigorously develop pick-up and delivery services, increase the proportion of container door-to-door transportation, actively expand door-to-door picking and packing services, and improve the overall logistics service capacity. To achieve the above business goals, each railway bureau needs to strengthen the organization of container freight sources, optimize transportation organization plans, accelerate container turnover, and improve transportation efficiency. The smooth implementation of such work relies on systematic and comprehensive railway logistics statistical data as support, providing scientific basis for market prediction, cargo source organization, transportation organization optimization, and other aspects of railway containers.

The Railway Container Transport Rules clearly state that "stations should make 'container usage reports' at 18:00 every day, and report container scheduling level by level. Optimize and improve the railway container transport management information system, and automatically generate' container usage reports'." The main indicators of container transport are divided into quantity indicators and quality indicators.

According to the Railway Container Transport Rules, currently, the quantity indicators for railway container transport business statistics include: TEU (Container Delivery Unit) and TEU (Arrival Unit); Shipping and arrival tons of containers; Container transportation revenue. Quality indicators include: average container stay time at

the station (days); Container ownership (TEU); Container turnover time (days). In addition to the above statistical indicators, in the daily statistics of the railway container transportation management information system, information on loading and unloading, entry and exit, delivery, entry and exit, launching, repair, scrapping, back-up, and new container input at each container handling station has also been entered into the system. In subsequent railway logistics statistics work, such data should also be included in the railway logistics statistics system, with the aim of serving China Railway Group The railway bureau provides better decision-making basis for guiding the development of railway container business.

2.2 Basic data types and content of container business

According to the operation flow chart of container business, various operations of railway container logistics services can be clearly defined. Combined with the basic work content in each operation link, the basic data types and content of railway container logistics services used for railway logistics statistics can be extracted, as shown in Figure 1. Considering the basic content of relevant data involved in each homework step, the data content involved in the "loading" stage will be merged and discussed with the "arrival and pick-up" and "unloading, arranging cargo space" stages.

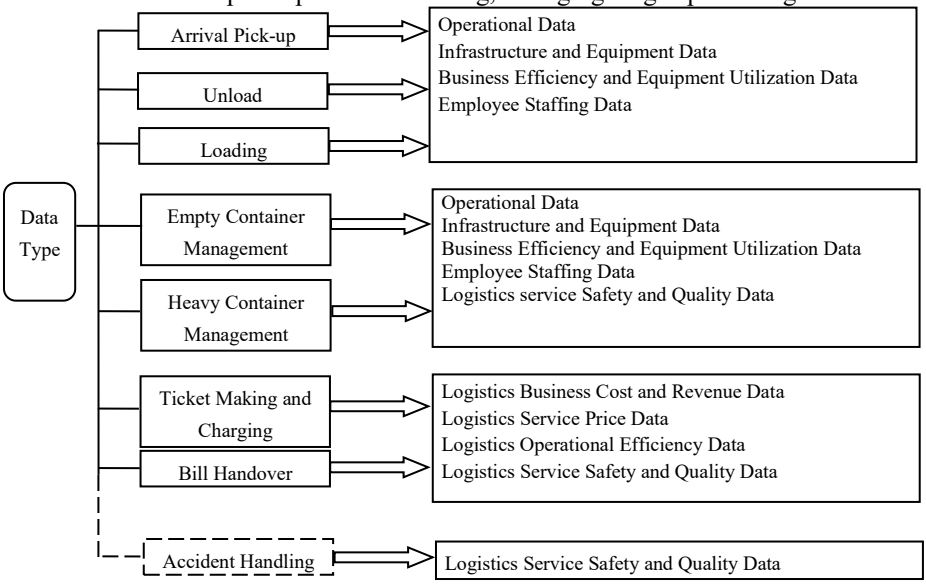

Fig. 1. Basic Data Types and Content of Railway Container Business

3 Construction of statistical indicator system for railway container business

3.1 System Framework

The evaluation index system for container business involves five aspects, including logistics business volume, logistics operational efficiency, logistics infrastructure and equipment, dynamic statistics of logistics management, and logistics service quality, as detailed in Table 1. Among them, logistics management dynamic statistics mainly involve dynamic statistical data in container business operation management, which is reported daily by the business department. Other statistical data shall be reported monthly or annually by relevant business departments.

Table 1. Statistical Indicator System and Calculation Method for Railway Container Logistics Business

Level I indicators	Level II indicators	Level III indicators
Logistics operation efficiency	Total revenue from container business (10000 yuan)	Revenue from freight invoices, transportation business, unpacking business, warehousing business, and other income
	Ton revenue rate (yuan/t)	
	Revenue rate by category (yuan/t)	Revenue rate of 152 types of goods (yuan/t) Revenue rate of non 152 category goods (yuan/t)
	Average price of containe business (yuan/t•km)	
	Container business profit (10000 yuan) Container business business business tax (10000 yuan)	
Logistics infrastructure equipment	Container ownership (TEU)	20 foot universal container, 40 foot universal container, special container, open top container; In station containers, in transit containers, outbound containers, and launch containers
	Average container loading and unloading time (min) Average container storage time (days)	
Logistics Management Dynamic Statistics (Daily report)	Container management	Containers that have been in transit for more than 150 days, containers that have been in transit for more than 30 days, containers that have been out of station for more than 10 days, number of container repair points in stock, 20 feet of yesterday's downtime (days), 40 feet of yesterday's downtime (days)
	Transportation monitoring	In transit containers (departure), in transit containers (arrival), stranded containers, and out of station containers
	Transportation analysis	Diversion to daily usage status (pieces), empty and heavy containers (pieces), average inventory (pieces), usage efficiency (%), average repair time (days), exit time (days),

		launch time (days), booking status (pieces)
Logistics service quality	On time transportation rate (%) Occurrence rate of goods damage and difference (%) Customer Satisfaction (%) Complaint rate of cargo owners (%) Effective complaint resolution rate (%) Complaint response time (hours)	

3.2 Computing Method

(1) Logistics business volume

Unpacking business volume: The volume of goods provided by railway transportation enterprises to customers during the reporting period. Measurement unit: 10000 tons.

(2) Logistics operation efficiency

1) Average Price of Container Business: The average price of container logistics services provided by railway transportation enterprises to customers during the reporting period, averaged based on freight ticket prices. Measurement unit: yuan/t • km.

2) Total revenue from container business: The total revenue from railway transportation enterprises providing container logistics services to customers during the reporting period. Measurement unit: 10000 yuan. The data is sourced from the financial statements of railway transportation enterprises. Including: revenue from freight invoices, transportation business, unpacking and packing business, warehousing business, and other income.

(3) Logistics infrastructure equipment

1) Container ownership: The number of containers owned by railway transportation enterprises during the reporting period. Measurement unit: TEU. Including: 20 foot universal box, 40 foot universal box, special box, open top box; In station containers, in transit containers, outbound containers, and down water tanks.

2) Average container loading and unloading time: The average loading and unloading time during the reporting period when railway transportation enterprises provide container loading and unloading services. Measurement unit: min.

3) Average container storage time: The average storage time during the reporting period when railway transportation enterprises provided container storage services. Measurement unit: day.

(4) Logistics Management Dynamic Statistics (Daily)

1) Container management: Real time situation of container management by railway transportation enterprises during the reporting period. Including: 150 days or more in station container, unit of measurement: piece; Box in transit for more than 30 days, measurement unit: piece; Box outside the station for more than 10 days, measurement

unit: piece; Quantity of box repair points, measured in pieces; 20 feet stopped yesterday, measured in days; 40 feet stopped yesterday, measured in days.

2) Transportation monitoring: The implementation of container transportation monitoring by railway transportation enterprises during the reporting period. Unit of measurement: piece. Including: in transit boxes (departure), in transit boxes (arrival), detention boxes, and out of station boxes.

3) Transportation analysis: The implementation of container transportation analysis by railway transportation enterprises during the reporting period. Including: daily usage of diversion direction, measurement unit: piece; Empty and heavy containers, unit of measurement: piece; Average ownership, measured in pieces; Application efficiency, measured in%; Average repair time, measured in days; Exit time, measured in days; Launching time, measured in days; Booking status, measurement unit: piece.

3.3 Optimization Analysis

Table 2. Statistical Indicator System and Calculation Method for Railway Container Logistics Business

Level I indicators	Level II indicators	Level III indicators
Logistics business volume	Container business volume	Delivery box (TEU), delivery ton (10000 tons)
	Unpacking business volume (10000 tons)	
Logistics operation efficiency	Total revenue from container business (10000 yuan)	Revenue from freight invoices, transportation business, unpacking business, warehousing business, and other income
	Ton revenue rate (yuan/t)	
	Revenue rate by category (yuan/t)	Revenue rate of 152 types of goods (yuan/t) Revenue rate of non 152 category goods (yuan/t)
	Average price of container busines (yuan/t • km)	
	Container business profit (10000 yuan) Container business business business tax (10000 yuan)	
Logistics infrastructure equipment	Container ownership (TEU)	20 foot universal container, 40 foot universal container, special container, open top container; In station containers, in transit containers, outbound containers, and launch containers
	Average container loading and unloading time (min) Average container storage time	

	(days)	
Logistics service quality	On time transportation rate (%) Occurrence rate of goods damage and difference (%) Customer Satisfaction (%) Complaint rate of cargo owners (%) Effective complaint resolution rate (%) Complaint response time (hours)	

The report for railway container business statistics is designed based on the basic content of railway container business transportation efficiency and workload statistics. The collection of dynamic statistical data related to logistics management is directly obtained from the "Railway Container Production Management Information System". Existing statistical reports such as container transportation daily status table, container category analysis table, container transportation revenue analysis table, and container transportation quality analysis table can be submitted and collected. Based on the development of railway container business, combined with the characteristics of railway container business and the needs of logistics statistics, an indicator system for evaluating the operational quality of railway container business has been established. The evaluation system includes five aspects: logistics business volume, logistics operational efficiency, logistics infrastructure and equipment, logistics management dynamic statistics, and logistics service quality. The specific indicator system structure is detailed in Table 1. The evaluation objects of this indicator system are railway bureaus, railway stations and depots, and professional transportation companies (China Railway Container Company). The evaluation system in Table 1 includes two aspects: static statistical data and dynamic statistical data. Therefore, when evaluating the operational quality of railway container business, it will be processed separately and divided into an overall evaluation of the operational quality of railway container business (with monthly, quarterly, and annual evaluation cycles) and a daily evaluation of the operational quality of railway container business (with daily evaluation cycles). This study investigates the static evaluation of railway container business and optimizes the indicator system in Table 1 based on the availability of statistical data. The evaluation indicator system obtained is detailed in Table 2.

4 conclusion

As a major artery of the national economy, railway transportation reflects the socio-economic development of the country to a certain extent. A good railway container logistics statistical system is conducive to the government's supervision and policy guidance of railways, and better serves the national economic construction. Railway container logistics is an important carrier for railways to expand the logistics market, playing an important role in supporting the development of multimodal transportation with containers as the core, and helping railway freight to transform and upgrade to logistics. By constructing a railway container logistics statistical indicator system that

meets the needs of railway container logistics development and conducting research on railway container logistics statistical methods, a market-oriented modern railway container logistics statistical system is established, closely combining the statistical system of enterprise business operations and sound statistical data, which can comprehensively reflect the operation of railway container logistics business units. Overall, it can showcase the development status of railway container logistics business, help railway transportation enterprises better understand their own operational situation, provide decision-making support for railway's own business development, formulation of policies and regulations, and determination of development direction, thereby improving the level of railway container logistics management, and providing theoretical basis and reference for the implementation of modern logistics statistics for railway containers in the future. It also provides decision-making support services for the railway container logistics management department, thereby guiding the healthy, rapid, and sustainable development of railway container logistics towards modern logistics.

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