



# Journal of Applied Sciences

ISSN 1812-5654

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## Research and Application of Railway Logistics Information Sharing System Based on SOA

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**Abstract:** In the last years, the development of railway logistics information systems has obtained apparent progress in China. The effective operation of railway logistics enterprise information system greatly depends on its advanced nature, in which the information sharing technology becomes an important part of the logistics information system. It has important guiding significance to achieve information sharing which is based on Service-Oriented Architecture. This study investigates the railway logistics enterprise information system, combines with China's railway information system characteristics and base on SOA to realize railway logistics information system for information sharing, it provides reference to railway logistics information development in the future.

**Key words:** Logistics, SOA, information sharing

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### INTRODUCTION

With the rapid deepening of Chinese economic development and the constant construction of the railway reform, railway logistics industry is developing rapidly. But the informationization construction is still in the initial stage. The weakness of information management foundation and the unreasonable structure have long been the main obstacle in logistics management to most of Chinese logistics enterprise and significantly weaken the competitiveness of domestic company (Dong and Liu, 2008). The state has attached great importance to the logistics industry. The development of domestic information technology and the research of logistics management information system have become more and more popular. Informationization of railway logistics has entered a period of accelerated development. In developed countries, logistics constructs earlier and has higher level of development. The American and Japanese are particularly prominent, their informatization construction are also more mature. The United States as the birthplace of the logistics industry has a very mature experience in logistics management and advanced information logistics. Japonic logistics development is very rapid and its informationization of logistics development level as well as those in Europe and America. In recent years, the development of France logistics informationization speeds at 10%, it has become an advanced logistics information state.

With the rapid development of information technology and electronic commerce, the traditional logistics mode has been unable to meet the changing needs of society and economy. The modern logistics has become an inevitable trend of logistics development. Information sharing may offset the bullwhip effect to improve performance, to lower costs and to reduce inventory in supply chain (Liu, 2008). In recent years, developed countries attach importance to the development of integrated logistics information system to integrate the logistics information system. Japan maximum logistics information service public system which name logilink based on exchanging and sharing the information, provides a comprehensive service. The European railway transportation composite system which named InteGRail, has realized information sharing in the railway transportation system. The system achieves greater capacity and enhances the security and optimization of infrastructure resources using. The Chinese railway ministry's opinions on promoting the diversification of railway clearly pointed out: the construction of overall railway diversified management information system and comprehensive utilization of existing information resources, set up information platform to meet the diversified needs of information sharing.

A lot of information sharing platform construction base on service-oriented architectures using (SOA, Service oriented architecture). SOA is a kind of services and infrastructure mode which allows the

exchange of data between different applications. It participates in business processes and serves as the basis, to coordinate the relationship between the system function and business process. In this way, it makes the separation from business and technology, make the service is located between business and technology (Weichao, 2009). SOA thought has important guiding value of in the integration of information systems integration of heterogeneous system and its application, the system integration theory of SOA, the in-depth study of the logistics information system, information sharing has important practical significance.

This study does an investigation on a railway logistics enterprises, researches and analysis the railway logistics information sharing requirements. It advances the SOA concept of the logistics information system, design scheme of the system and to realize the information system in the logistics enterprises.

#### **ANALYSIS OF RAILWAY LOGISTICS INFORMATION SHARING REQUIREMENTS**

Logistics information sharing is the nerve center of logistics activities which uses the information technology to form a whole flow of the logistics and transport and makes full use of all resources to ensure the efficient operation of logistics. Scholars have discussed from different perspectives that share information can bring overall benefits to all the members of the logistics (Liang and Tang, 2004). It is an important technique to accelerate the development of logistics industry. Logistics information system integrates heterogeneous resources effectively, so as to eliminate the "information island", realize the logistics information system information sharing, improve logistics efficiency and reduce logistics costs. The traditional logistics information system aimed at various sectors to achieve their business needs, application systems are designed separately. There is no uniform standard, information resources severely divided, unable to achieve a unified maintenance and interaction between the systems (Li *et al.*, 2008). Because of this reason, logistics information system information sharing has become an urgent problem in modern logistics technology.

This study researched the railway logistics enterprises and got the demand of its information sharing. The research results are as follows:

- **Logistics customer information inquiries:** The emergence of internet, electronic commerce, has greatly improved the efficiency of communication (Zheng, 2008). Railway Logistics is based on the

railway transportation, so its transportation is convenient. But the railway logistics enterprises can't feedback large amounts of transport information to customers timely, allow customers to understand the transport of goods which can greatly reduce the railway logistics service quality. Therefore, the railway logistics enterprises should have an electronic commerce system with perfect function, for the society, for customers to share and transfer transport information and ensure the accuracy and timeliness of information

- **Enterprise staff for transportation information query:** Railway transportation is divided into many modules, such as railway transport vehicle, railway container transportation, highway transportation, warehousing and so on. These operations are completed independently, but have the connections between each module. All the operations group together is a complete logistics and transport processes. The workers of enterprises need to query for the entire transport information, to grasp the completion of logistics transportation and make the decision to the next step work. So it needs a logistics information sharing platform which link each relatively independent integrated together, to provide a complete logistics information query
- **Each branch unified data demand:** The logistics enterprise has a plurality of branch. Because of the company business characteristics and business processes are not the same, each branch has different business data and their information system data types are not the same which resulted in the difficulties for corporation operation by statistical department. The information sharing platform, is selected for data mapping, obtains the uniform data format to meet the statistical requirements for company. Sharing platform is an information sharing platform for logistics enterprises which contains the basic data. It realizes the centralized arrangement and unified management, to ensure the authority and accuracy of data
- **The internal transactions of information sharing requirements:** Railway logistics is mainly relying on the railway transportation. A great part of its business needs the communication and coordination dispatching of the Railway Bureau which has three parts of information to share. The first one is the information sharing about the customer contracts system of Railway Bureau and the information system of logistics enterprise. All the customers' contract is managed by the Railway Bureau, so the logistics enterprises should get customer information

from the customer contract system of Railway Administration. The second is the logistics vehicle, container service freight and Railway Bureau freight system should have information sharing. When the logistics enterprise transportation planning is completed, it is need to provide the plan to the Railway Bureau. The railway bureau approve car information in the freight system. So it needs information sharing between the two systems to realize the logistics enterprises making transport planning according to the recognition of vehicle information. The third is associated business information sharing. The "door to door" logistics mode contains highway transportation, storage, transport vehicle, container transport business. It needs each business module provides logistics information to other business module to achieve seamless connection association business through information sharing. All the modules cooperate to complete the "door to door" transport task

#### **RAILWAY LOGISTICS INFORMATION SHARING SCHEME BASED ON SOA**

In this study, according to the demand analysis of the actual business of railway logistics enterprises and the investigation of information sharing, different logistics information system function as service provided by SOA framework, in order to receive and respond through information sharing. To ensure the autonomy of different logistics business information system, the information sharing will not affect the normal operation of the existing system. SOA framework is extensible, so it adapts to the changing demand.

The whole railway logistics information system is divided into three modules: The enterprise logistics management information system, electronic commerce system and information sharing mechanism.

The management information system of railway logistics enterprises is a module for internal staff which realizes the logistics business process operation functions. It contains the company's various business systems, such as railway vehicle system, railway container business system, warehousing operations system, statistical analysis system, road transport operations system and so on. Each business system finishes its own logistics operations independently.

Electronic commerce platform is a module for the customers, realizes the logistics business customers submitting their orders and inquiring logistics business details. It mainly includes: the logistics business and logistics query.

Information sharing mechanism of information system is a background module. The implementation of the system is the information storage function, including the shared database and information sharing platform. The information system needs to get the customer contract information and the freight information from the system of Railway Administration. The overall is shown in Fig. 1.

The design based on SOA framework is divided into five layers which are the presentation layer, business process layer, service layer, business components layer, system application layer. The logistics information system architecture model is shown in Fig. 2:

- **Operation layer:** This layer contains the operating system existing in the enterprise the current IT environment, supporting business activities. Operating system includes all custom packaged applications: logistics information management system, customer business platform system and databases and legacy systems
- **Service component layer:** This layer component meets the definition of service layer and contract. Service component gathered from multiple operating systems may be completely different. Various functions encapsulate it using the Web Service Wrapper will be used to provide application system layer into different particle size of service and provides the external interface of Service based on Web
- **Business service layer:** This layer contains all the definitions in the enterprise service and portfolio service. The definition of each service is composed of syntactic and semantic information. Service definition makes them accessible to consumers, but also independent transmission protocol implementation
- **Service process layer:** Describes the business execution, on behalf of the loosely coupled services aggregation process. According to the logistics business process, it uses the service layer provides related services to form the application information system
- **Consumer layer:** This layer describes the different channels. The function of IT through these channels to deliver. Channels can reflect different types of users, for example, the enterprise internal staff and external customers, through their access mechanism in different ways, realize the function of access applications (Erl, 2005)

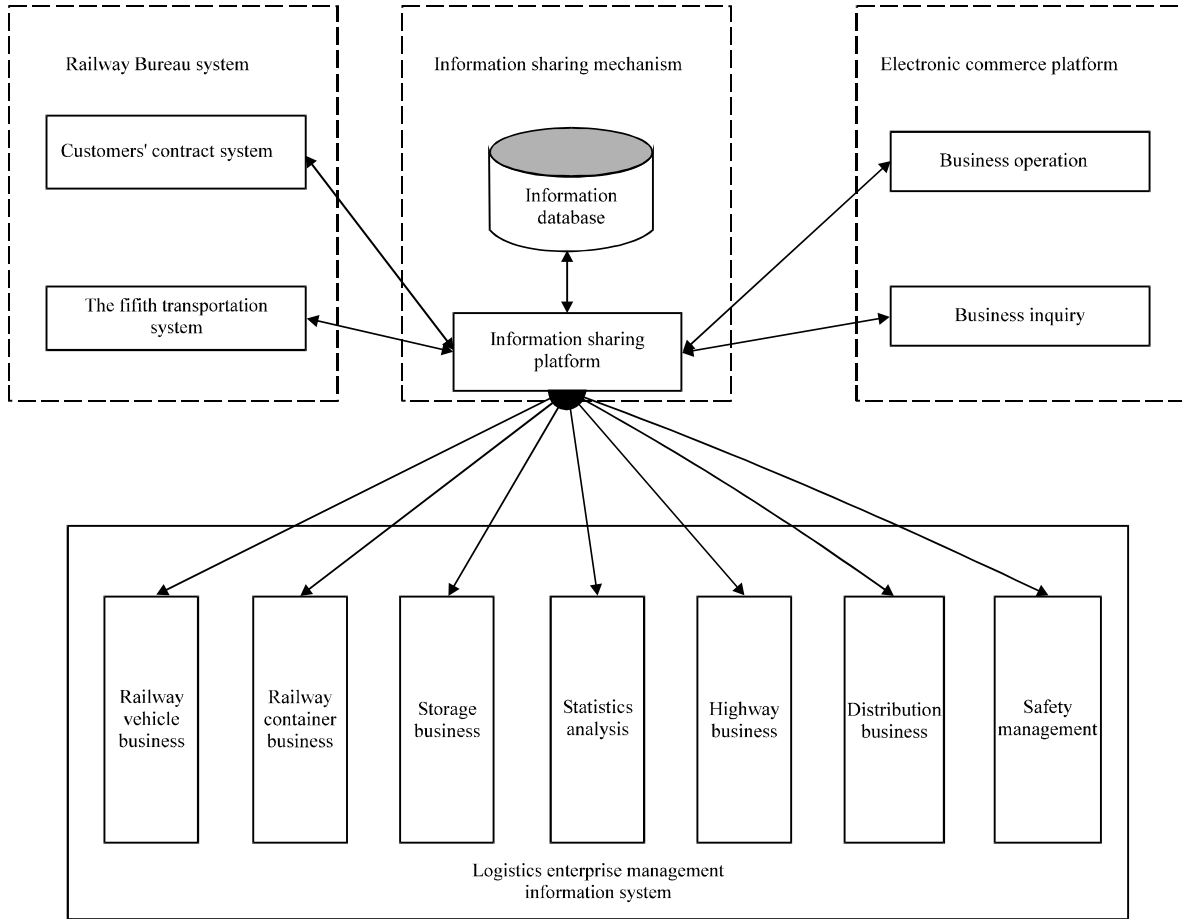


Fig. 1: Railway logistics information system of SOA based on the overall framework

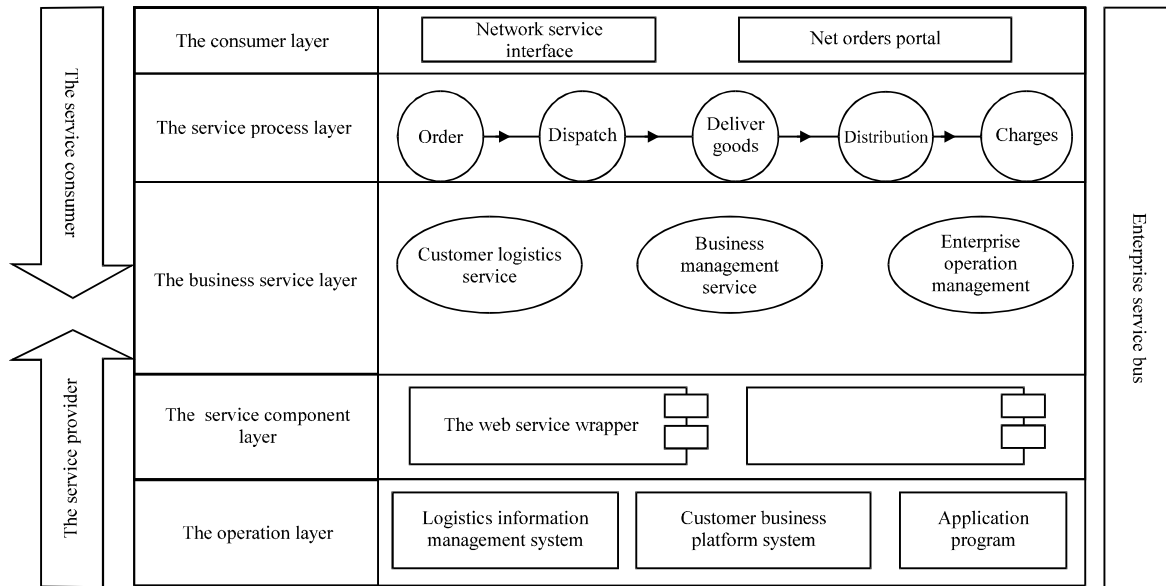


Fig. 2: Railway logistics information management system of SOA based on the framework

**EXAMPLES OF RAILWAY LOGISTICS INFORMATION SYSTEM**

The railway logistics information system is developed by the component technology and B/S architecture based on J2EE technology platform. The data layer is managed by Hibernate. The presentation layer uses JSP page to implement. It carries on the management to the business layer using the spring technology. The client only needs a browser which can realize the functional business functions and the corresponding management system. Spatial data generally store in the distribution server in a variety of heterogeneous way. These servers consists of different database, system platforms, besides these servers may be protected by

respective firewall, thus remote user is unable to directly obtain these data (Chentao, 2002). According to module design, each module is developed independently and established corresponding data form. The information sharing platform as the central nervous system, integrates all modules into a complete railway logistics information system. Take the information sharing between the e-commerce platform and enterprise logistics management information system for example, its technical architecture is shown in Fig. 3.

The "door to door" service flow in the Logistics enterprises is shown in Fig. 4.

Customers submit logistics business information by the electronic commerce platform. Enterprise logistics information system gets the customers' information from

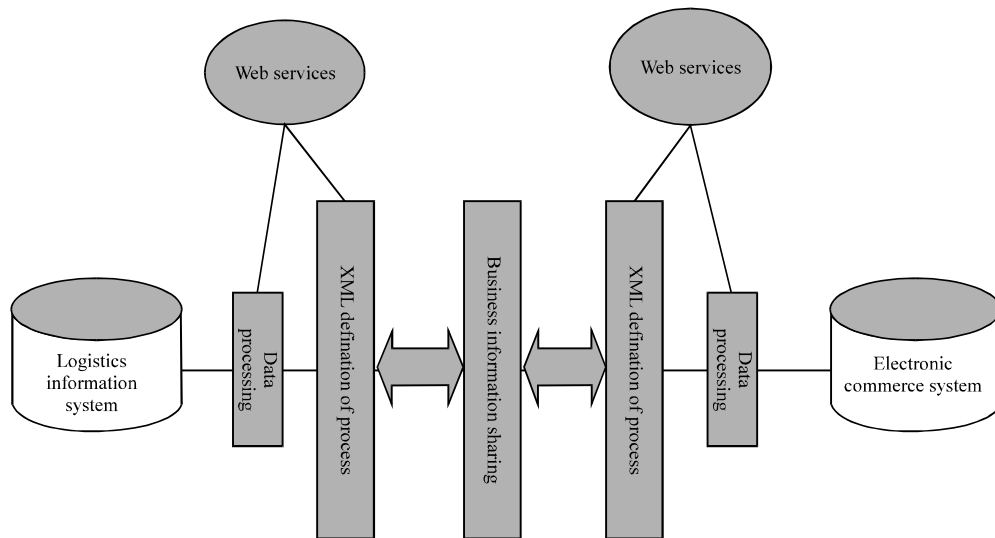


Fig. 3: Information sharing technology architecture diagram between e-commerce platform and logistics management

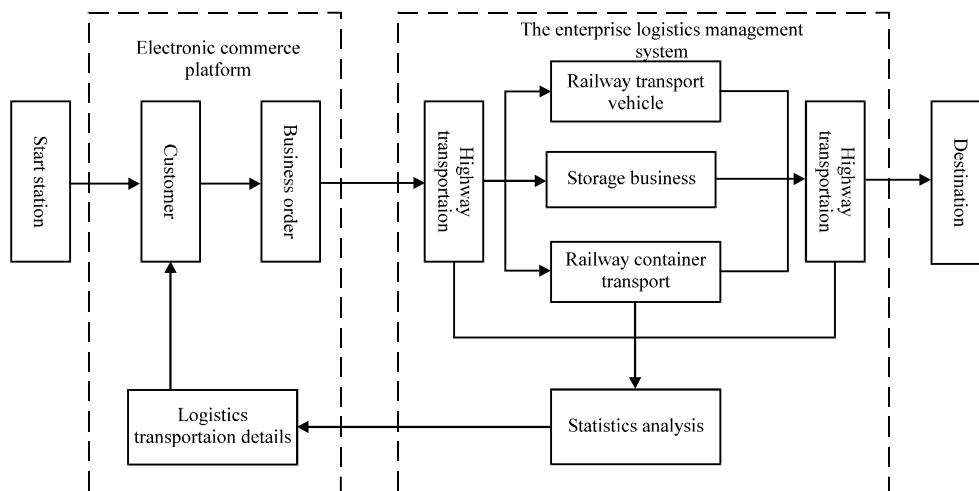


Fig. 4: "Door to door" logistics service flow chart

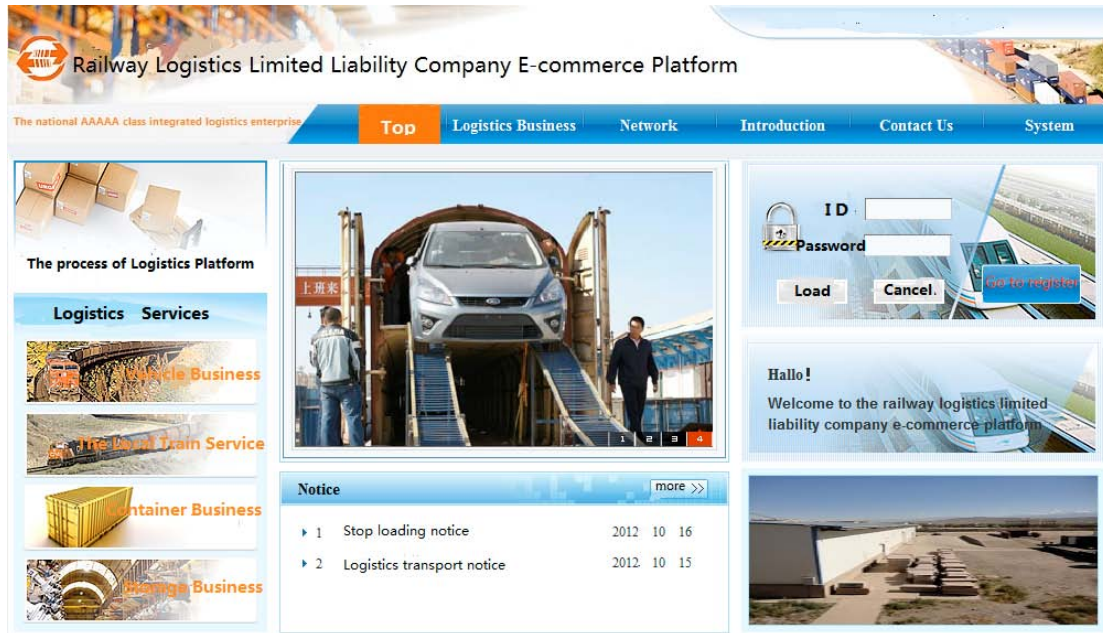


Fig. 5: The login interface of e-commerce platform

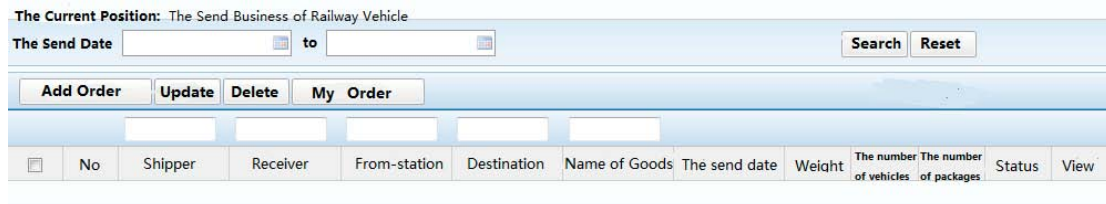


Fig. 6: The interface of customers submit orders in the electronic commerce platform

the information sharing platform. And then it organizes the logistics business module for transport. In the process of transportation, logistics information system transmits information to the information sharing platform continuously. The customer can obtain logistics information by the electronic commerce platform. In this way, it can realize the information sharing between e-commerce platform and enterprise logistics information system.

After the registration of the customer, the logistics staff checks it up. If it is approvable, customer can login the e-commerce platform. The e-commerce platform interface is shown in Fig. 5.

Customers input business information in logistics business module and submit information to the information sharing platform. Take sending business vehicle for an example, the business interface is shown in Fig. 6.

Enterprise logistics management information system platform obtains customer information from sharing information, to logistics business classification, then transfer the service information to corresponding service module. The first step is road transportation in the complete service mode -- "door to door" logistics services which transport goods from the source place of carriage to the train station. According to the type of business it organizes storage business, railway transport vehicle or railway container transport. After the arrival of goods, road transportation transports the goods to the destination. Take railway transport vehicle as an example, sending operation interface is shown in Fig. 7.

Statistics analysis module which gather the transportation information and then feedbacks the information to sharing platform. The customer can inquire the statistics information by the client module of electronic business the platform, to understand the transport business.

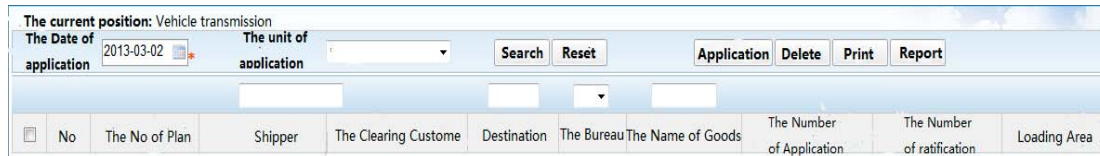


Fig. 7: The interface of vehicle business sending operation

Logistics enterprise management information system gets business information submitted by e-commerce platform and the customer contract information submitted by the Railway Bureau management system from the information sharing platform at the same time. By the two categories of information matching correlation, it realizes the management of customer contract transport tasks.

Railway transport vehicle module and the railway container transport module obtain transport task, according to the transport planning of railway logistics transportation task, submit request car instructions plan to the Railway Bureau. The Railway Bureau will store the railway car information in the fifth transportation system and transfer the information to the information sharing platform. Railway transport vehicle module and the railway container transport module compose the information of the fifth transportation from the information sharing platform, vehicle information plan according to the request, request instructions matching car plan, reorganize the railway vehicle and container transportation.

Statistics analysis module of logistics enterprise management information system analyses the logistics information submitted by the logistics service module from the information sharing platform. Develop different statistical query conditions according to the staff, to obtain the corresponding business data in the form of data from the sharing of information statistics module, the summary statistics for data analysis, statistical report form in the staff client performance. Take highway transportation service as an example, in the selected period, inquire the road transport of goods and can be based on the selected conditions, inquire volume respectively.

### CONCLUSION

In this study, through the study of railway logistics information sharing, according to the actual business situation of railway logistics enterprises, develop an information system of the railway logistics which realize information sharing. The application of logistics

information system proves the important role of the information sharing in logistics enterprises. Information sharing can optimize logistics business process, play the advantages of railway system. It can also synthesize existing information system, promote the development and optimize the allocation of internal resources of the logistics industry. It realizes the scientific management, improves the business management level and enhances market competition ability, to provide a reliable guarantee for the development of railway logistics enterprises. To realize the information sharing of railway logistics information system is an important development of modern logistics information system.

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