Mode of Freight Rolling and Collecting and Distributing Based on Cloud Logistics Platform

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ABSTRACT: With the application of Internet and electronic information technologies, cloud logistics platform, as a means of operation of new information flow, can effectively solve the problem of goods rolling, collecting and dispatching by utilizing its efficient information transmission, timely response, optimization and integration. This paper summarizes the development status and main problems of cargo rolling transport, and proposes the preliminary planning framework of the cargo rolling and collecting logistics network platform, including the construction requirements, system architecture and functional system design. In addition, we also propose the rolling and collecting mode and the operation mode based on the cloud logistics platform.

1. INTRODUCTION

Ro-Ro transport is a multi-modal transport mode that realizes seamless connection, improves cabin utilization and ensures transport safety in the organization mode of land and sea transport. It is an important link to promote the circulation and commercial development of goods on both sides of the Straits, the Inland Sea or the river. Ro-Ro transport is a transportation organization mode. The whole process is as follows: first the goods on the trailer are moved by the tractor to the ro-ro ship; after the trailer and the cargo are smashed down, the tractor is disembarked; and then the cargo and the trailer are bundled fixed, and shipped to the destination port; finally the tractor waiting for the port tows the trailer to disembark and transports the goods to the destination.

In the literature, many studies have focused on research goods collection and distribution. Jin \cite{1} studied the organization method and countermeasures of the hanging transport in the ro-ro transport; Liu \cite{2} investigated the seamless transport system of the land and sea in the Bohai Sea area; Fan \cite{3} examined the scheduling optimization of the mounted and transported tractors; Qu \cite{4} studied the ro-
ro and hoisting transport of Luluo Luhai. Li [5] carried out the analysis of the transportation mode of land, sea and cargo rolling and its countermeasures. Chu [6] took Guojiayu port area as an example to study the optimization analysis of the port-based transportation and distribution system based on ro-ro transportation; Li et al. [7] studied the transportation mode and promotion strategy of the cargo around the Bohai Bay. In the research of "cloud computing" and "cloud logistics", Liu [8] proposed the goal, principle, implementation process, promotion mode and development trend of building smart cloud logistics; Cao [9] summarized relevant theories and technologies of cloud computing and logistics public information platform and analyzed the issues of the system architecture, system design and function realization of the logistics information platform. Han [10] studied in detail the role of the Internet of Things technology, cloud computing technology and SOA architecture in the construction of each layer of the platform. Kong [11] proposed a task allocation method and task assignment model with cloud logistics characteristics from the perspective of cloud logistics platform. Gong [12] proposed a method of using cloud computing and cloud logistics to form a logistics demand information integration platform to realize information's Exchange, process, transfer, integrate logistics resources, and maximize logistics benefits.

The contribution of this work is to propose the construction requirements, system architecture and functional design of the logistics and logistics platform for cargo rolling through analyzing the current situation and problems of freight-rolling and hoisting transportation. Moreover, it develops the organization mode of cargo collection and distribution based on cloud logistics platform

2. THE DEVELOPMENT STATUS AND PROBLEMS OF GOODS ROLLING AND HANGING TRANSPORTATION

2.1 Development Situation of Goods Rolling and Hanging Transportation
China's ro-ro transportation has formed four major ro-ro transport regional markets, including the Qiongzhou Strait, the Zhoushan Islands, the upper reaches of the Yangtze River and the Bohai Bay. Due to the late start of China's ro-ro transportation development, it has the low efficiency of cargo collection, the poor information circulation, low sharing, and the high logistics cost. At present, it is still in the process of transition from the traditional mode to the information model. There are many transportation companies. However, most are the traditional business management mode with small scale and low informationization, service level and service awareness. At the same time, the transportation organization mode of cargo rolling and slinging is still in the pilot operation, and has not yet formed a platform for cargo collection and distribution information service.

The reasonable combination of ro-ro transport and drop and pull transport can solve the problems of safety and standardization in ro-ro transport, and can greatly improve the transport efficiency. Therefore, after the informatization development reaches a certain level, it has been widely applied in Europe. Today, the ro-ro-hanging transportation in developed countries and regions in Europe and America has entered a mature stage. The information management of ro-ro-hanging transportation is high. A regional logistics information service platform has been set up. The ro-ro transportation terminal management system has obtained the comprehensive construction and improvement. Roll-to-roll transportation in developed countries in Europe and America has begun to develop in the direction of intelligent, cross-regional services, large-scale ro-ro ship and high-speed transportation.

2.2 The problem of traditional goods rolling and transporting
China's ro-ro-hanging transportation enterprises have a low informatization. Most enterprises are still in the traditional ro-ro cargo transportation stage. Information transmission is mainly based on telephone, fax, paper documents and manual entry. Low cooperation results in independent logistics, slow information flow, long response time and low level of logistics services. The traditional cargo rolling and collecting organization mode is shown in Figure 1.
2.3 The problems with traditional cargo rolling and shipping

1. The types of domestic trailers are numerous and complicated. In the process of hanging and hanging, there are often cases. For example, the trailer and trailer types do not match; the pairing is unsuccessful; the goods cannot be transported out of the ro-ro terminal in time.

2. The shipping company has fewer sources of supply, less supply and instability, and difficulties in collecting goods, resulting in a low loading rate of ro-ro ships.

3. The cargo source information distribution channel and the carrier information acquisition channel are blocked. It is difficult to find a suitable carrier driver and carrier shipping company. The goods cannot be shipped out to the destination in time, the storage and transportation costs are high.

4. The few sources of the source information of the trailer driver, the high cost of the source information channel, and the high short-selling rate, result in low driver income.

5. Due to the information asymmetry between the loading and unloading of the trailer, vehicles return without goods, which results in high empty driving.

3. CARGO ROLLING COLLECTION AND DISTRIBUTION CLOUD LOGISTICS PLATFORM PLANNING

3.1 Construction needs

The users of the logistics and logistics platform include the logistics service provider, the logistics service demander, the government management department and the platform operation organization. The information needs of users are as follows:

1. Logistics service provider
   The logistics service providers mainly include ro-ro ship companies, freight forwarding companies, third-party logistics companies, and transportation drivers. Ro-Ro shipping companies need to release information on Ro-Ro ships, cabins, freight rates, etc. on the platform; freight forwarding companies need to publish and find information on sources, shipping resources, and transport drivers on the platform, especially in advance booking and matching, hanging, transportation and distribution; third-party logistics companies need system support in the collection of scattered goods, dynamic tracking of trailers, transportation organization, vehicle scheduling, etc.; transportation drivers need the information support and guidance in supply, transportation fleet, ship location etc.

2. Logistics service demand side
   The logistics service demand side, that is, the cargo owner, needs to find the information of the logistics enterprise, vehicle and ship quickly; it needs to understand the basic information of the logistics enterprise, credit record, qualification information of the employees and operating vehicles, etc. in order to choose a good reputation and high service quality. Logistics enterprises with security guarantees carry out logistics transaction activities; real-time access to shipping schedules and ro-ro ship transportation status information is required in order to arrange delivery plans and intermodal handovers in advance.

3. Government management department
   Government management departments need to provide the information resources to the market, and obtain market feedback information or data to improve the supervision and decision-making ability of the goods in the market. Meanwhile, they are obliged to release the relevant policies,
regulations, and procedures regarding goods transportation, increase the channels for propaganda of laws and regulations, and reduce the cost of approval for suppliers and demanders of logistics services.

(4) Platform operators

In addition to the daily management needs, the platform operators can also provide support for platform management through the mining and processing of historical data and information. On the other hand, it provides value-added services for logistics consulting for users with special needs. The operational service level provides objective evaluation and analysis, and proposes appropriate improvement and upgrade plans in the maintenance and update of the platform software and hardware.

3.2 Architecture

(1) Operating system

It establishes a cloud logistics platform for customer service with information integration and efficient intelligence. Focusing on the integrated logistics needs of customers, it uses the Internet technology to turn ro-ro shipping companies, freight forwarding companies, third-party logistics companies, all kinds of information of transport drivers, cargo owners and other institutions together to realize logistics information sharing, provide operational process support and intelligent management services for the whole process of collecting and distributing, and realize the seamless docking of land and sea transport in two areas of ro-ro transport.

(2) Architecture

On the basis of cloud services, the architecture of the logistics system is mainly composed of three types of cloud services: infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS). The logistics and logistics platform is located between the terminal users and the physical infrastructure, including the application software layer, the platform service support layer and the infrastructure service layer. The physical infrastructure consists of physical hardware facilities such as servers, computer rooms, and network equipment. It is the foundation of the cloud logistics platform and provides physical support for the platform. The infrastructure service layer is based on the basic service layer built on the logistics infrastructure. The application software layer and platform service support layer provide cloud storage, cloud computing and cloud transmission capabilities; the platform service support layer is the provider of applications and common components required by the cloud logistics platform, through which users can register and manage their personal information and security settings; the application software layer provides various services for terminal users, including platform information services, platform interface services, application system services, and software services.

(3) Functional system design

According to the platform architecture design and the needs of customers, it develops the logistics platform based on the platform portal, and the platform of the user service window and the comprehensive logistics information display site. These platforms can be expanded through the portal content, service system and operation ways. With logistics service providers, logistics service demanders, government management departments and platform operators as the entry point, a comprehensive information web site on the integration of goods, information, regional influence Portal is developed. According to the information needs of customer service, qualification certification and credit service, business service, e-commerce application service, collaborative operation service, vehicle and ship dispatch service and dynamic tracking service, the company develop the cloud logistics platform with the service purposes of "trust one time", "the bill of lading "one in the end", and "one-time collection". The platform service function system includes: “one-unit” business service function, e-commerce application service function, qualification certification and credit service function, transportation organization collaborative operation service function, vehicle and ship dispatch service function, cargo vehicle and ship dynamic tracking service function, “one The "stationary" customer service function and operational decision support service functions, as shown in Figure 2.
4. THE CARGO ROLLING AND COLLECTING MODE BASED ON THE CLOUD LOGISTICS PLATFORM

4.1 The goods roll, the collection and distribution organization mode under cloud logistics platform

Taking the cloud logistics platform as the core, the platform's information mining, information processing and information distribution functions are used to effectively integrate the logistics resources of Ro-Ro ship companies, cargo owners, drivers, freight forwarders and third-party logistics companies onto the platform. The processing technology is used to allocate the data reasonably and effectively, and finally the processed information is distributed to the logistics entities of the goods collection and distribution organization. Through making advantages of each logistics entity and effectively matching them, the platform adopts an optimal way to integrate decentralized logistics resources, so as to maximize the utilization of logistics resources and to form an efficient organization model for goods collection and distribution.

The Ro-Ro shipping company can realize the rapid arrival of goods and the distribution of goods by port, so as to achieve rapid collection of goods; freight forwarding companies can better cooperate and share information with ro-ro ship companies and transport drivers. They timely find the transportation of goods tools and transport the company's foods to the destination as soon as possible, while using the platform for online booking business; third-party logistics companies can better cooperate and share information with the Ro-Ro ship company, get more sources and better arrange transportation fleet transportation and distribution; the trailer driver can transport the goods back and forth between the two places on time and can load the goods; the cargo owner can quickly find the carrier and timely load the goods out of the warehouse, transport to the destination, and realize real-time monitoring of the whole process. The mode of transporting cargo collection and storage is shown in Figure 3:

Figure 2. Functional system diagram of the cargo rolling and collecting and distributing cloud logistics platform
4.2 Cloud logistics platform-based the operation mode of the goods collection and distribution service

4.2.1 Ro-Ro ship company operating mode
There are two operating modes of the Ro-Ro ship company: one is the passive cargo collection and operation mode; the other is the active cargo collection and operation mode.

The passive cargo collection and operation mode can release the ro-ro transportation information through the platform, such as ro-ro ship cabin, navigation route, ro-ro transportation information on ports, departure times and ro-ro shipping prices; online booking services are also available. Cargo owners, freight forwarders and third-party logistics companies in the port area can carry out ro-ro ship information inquiry and space reservation through the platform, and deliver the goods to the port within the time specified by the Ro-Ro ship-company, and carry out detailed information such as cargo and trailer. After the registration is filed, the trailer enters the cabin and is shipped. After the ro-ro ship departing from ports, the shipping company will release the information on the loading cargo, the trailer model, the arrival time of the ro-ro ship, the port of call, etc. on the platform. The driver of the trailer in the destination port will inquire through the platform and pick up the transportation task wait at the port for the specified time required by the Ro-Ro shipping company. After the ro-ro ship is docked, the trailer is loaded onto the trailer. After registration, the trailer is towed away from the ro-ro ship and sent to the destination to complete the cargo transportation task, as shown in Figure 4.
Figure 4. The passive cargo collection and operation mode of the Ro-Ro ship company

The active cargo collection and operation mode is that the Ro-Ro shipping company can release the information of the Ro-Ro transportation through the platform. It can strengthen the communication with the freight forwarding enterprises and the third-party logistics enterprises through the platform, promote the cooperation agreement on the Ro-Ro ship transportation and signed a cooperation contract. When the scheduled transportation volume is reached within the time limit stipulated in the contract, the freight forwarding company or the third-party logistics enterprise that cooperates with the Ro-Ro shipping company can preferentially book the cabin and obtain certain preferential offers for mutual benefit.

In addition, the Ro-Ro shipping company can take advantage of its rich logistics resources information and cooperate with the transportation drivers to form a stern transport fleet led and operated by the Ro-Ro ship company, responsible for the transportation and delivery of goods arriving at ports. Through the cloud logistics platform, the Ro-Ro shipping company provides logistics resource information to the transportation drivers. After the ship arrives at the port, the organization organizes the transportation fleet to deliver the goods to the destination at the fastest speed. At the same time, the Ro-Ro shipping company through cooperating with freight forwarders and third-party logistics enterprises can collect the goods at the destination and transport them to the port, so as to realize the seamless connection of land and sea transportation, as shown in Figure 5.
4.2.2 Freight Forwarding Enterprise Operation Mode

The freight forwarding enterprise can query the source information through the platform, negotiate with the owner through the platform, and finally reach the cargo shipping agreement. The freight forwarder can also release the source information on the platform. This provides cargo information for drivers and third-party logistics companies. The freight forwarding enterprises can use the platform to make cargo transportation agreements with drivers and third-party logistics companies to complete transportation tasks. Freight forwarders can also complete cabin reservations through platforms and reach cargo transportation cooperation with Ro-Ro shipping companies. The agreement provides supply to the Ro-Ro ship company for transportation cooperation, as shown in Figure 6.
4.2.3 Third Party Logistics Enterprise Operation Mode
The third-party logistics enterprise becomes a member of the platform. It can release the fleet transportation capacity, warehousing and other information through the platform, and at the same time find the source information published by the cargo owner and freight forwarding company. After the enterprise reaches the carrier agreement, the goods are loaded and transported to the warehouse and freight center of the logistics enterprise, and then the less-than-truckload goods are packed and carpooled. Then the company fleet transports the goods to the terminal for ro-ro transportation; after goods reaching the destination terminal, the owners with less-than-truckload cargo are provided by devanning services and carpooling. That is, unpacking separate delivery services, ultimately transports the goods to their destination. Third-party logistics companies can also complete the booking of the space through the platform, and reach a cargo transportation cooperation agreement with the Ro-Ro shipping company to provide the Ro-Ro shipping company with a transport fleet to carry out cargo transportation cooperation, as shown in Figure 7.

![Figure 7. Third-party logistics business operation mode](image)

4.2.4 Transport driver transport mode
The transport drivers can publish the vehicle source information on the platform, waiting for the owner to contact and reach the carrier agreement to complete the carrier task. They also can find the source information through the platform and contact the owner, freight forwarding companies or ro-ro shipping companies to pick up transportation tasks. After drivers making a shipping agreement, they safely deliver them to destinations for completing transportation tasks. Drivers can build transport fleets through platforms in order to receive more transportation tasks and improve the efficiency of transportation, as shown in Figure 8.
4.2.5 Shipper Delivery Mode

Cargo owners can release goods information on the platform, waiting for the transportation driver or the third-party logistics enterprise to pick up the transportation task and transport the goods to the destination. The cargo owners can also inquire the transportation ability of the driver or third-party logistics enterprise through the platform and finally reach the carrier agreement to complete the delivery task, as shown in Figure 9.

Figure 8. the transportation mode of the transport driver

Figure 9. Shipper delivery mode
5. CONCLUSION

Based on the cloud logistics platform, the roll-and-roll collection and distribution mode will integrate and optimize all elements related to goods organization and transportation consisting of the rolling company, cargo owner, transportation driver, freight forwarding company, third-party logistics enterprise and ro-ro terminal enterprise. Through the cloud logistics platform, efforts are made in this work to solve problems such as imperfect information systems, poor flow of resource information, and low level of information sharing. The cloud logistics platform should be the inevitable trend of the future development of the ro-ro transport industry. It still needs the relevant departments to promote it. It is widely recognized in the industry and forms a coalition organization to jointly formulate relevant rules and regulations and jointly organize operation management.

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