

Research on Port Logistics Development Model Based on Supply Chain Management

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Abstract With the deepening of the Supply Chain Management (SCM) thinking, the port is gradually applied the relevant theory to develop its logistics model. This paper uses the theoretical and empirical analysis method, summarizes and compares the existing development models of port logistics, and then proposes that the Supply Chain Model (SC-Model) is an important trend in the development of port logistics, especially researches the structure and characteristics of SC-Model. Finally, this paper analyzes the current problem of SC-Model in China's ports, proposes the solutions accordingly, and obtains the conclusion that the establishment of coordination and information mechanisms is very important for the development of port supply chain.

Key words SCM; Port; Logistics; SC-Model

1 Introduction

As an important node of urban development, port plays a decisive role in the whole logistics system. It connects the cargo owners and shipping companies, and involves the freight forwarding, transportation companies, government, banks and many other enterprises. It has strong pull effect on local economic growth. Therefore, how to develop the port logistics better and faster, to seek the suited logistics development models for the ports has become a critical concern. As the characteristics of each port are different, the logistic models they use are also different. In many models, with the globalization of SCM, a new port logistics development model-Supply Chain Model (SC-Model) is also gradually on the rise. In the field of SCM, the traditional concept of supply chain limits to the internal operations of enterprises and focuses on corporate self-interest. Many researches concentrate on manufacturing companies and hold that supply chain is an internal process of manufacturing companies. It refers to a process of passing the raw materials procured and components received to manufacturing business through production conversion or sales. Modern researches on SCM more focus on coordination and cooperation. The main coordination mechanisms are: ordering quantity contract, discount of returning contract, the time discount contract and sharing information of supply chain (Charles J. Corbett et al., 2000). Some scholars start from the relationship of supply chain coordination, use mixed integer programming to research the strategy level, give an optimal model, and describe its effects upon decision of business management (C.Haehling von Lanzenuer and K.Pilz-Glombik, 2001). The representative studies of domestic scholars on the supply chain are: integrated supply chain, agile supply chain, supply chain operations, and the study of optimization and reconstruction, etc (Wang Jiuhe, 2007).

With increasingly fierce competition among ports, SCM thinking is gradually applied to the port construction. At present, on the applications of the port supply chain, researches have focused the strategy determinations (Song, D.W., 2008), partner selection, the positioning of port function and other aspects. Some scholars analyze the building of strategic partnership on modern port logistics supply chain (Gilbert N. Nyaga et al, 2010). There are also some scholars that put forward the expand functions based on global SCM (Luo Lingyuan and Zhou Yuechao, 2006). As the researchers have different interests, the current studies are scattered in different areas. In the filed of research on supply chain design and operation, results are fruitful, but most of the more successful applications limit to the manufacturing. On the port research, most studies focus on the practical cases and lack universality.

2 Port Logistics Development Model

The determination and planning of port logistics development model is a key issue related to the port function location and the core competitiveness. The operating mechanism of the modern port needs innovation. It needs to advance with the times to seek the own logistics model according to local conditions. At present, the foreign port logistics development models can be summarized into three: Rotterdam port model, Antwerp port model and Singapore port model. Each model has its own characteristics in the physical environment, hardware, management and government support. While the

domestic port logistics development models can be summarized into six: Hong Kong model, model of international shipping center, model of port regional logistics system, model of supply chain strategic alliance, model of zone-port interactive and bonded port area, and port logistics "network layout" model. The features and respective ports of each model are showed in Table 1.

Table 1 Comparison of Port Logistics Development Models

Area	Model	Features	Respective Ports
Foreign	Rotterdam port model	Landlord type, unified planning by government and makes their own decisions by business.	Rotterdam Port
	Antwerp port model	Co-funding type, "one-stop, door to door, frame to frame" comprehensive service, and perfect transportation network.	Antwerp Port
	Singapore port model	Joint type, direct investment by government, a free port policy, intensive management, and service diversification.	Singapore Port
Domestic	Hong Kong model	Independent type, self-organizing logistics center, one-stop and integrated service, attention to personnel training.	Hong Kong Port
	International shipping center model	Container hub port, dense routes, deep channel, a complete network of collecting and distributing, and perfect service functions.	Shanghai Port
	Model of port regional logistics system	Port area is the center. Building the "Port Logistics Park - Logistics Center - Distribution Center" integrated model.	None
	Zone-port interactive and bonded port area model	Establish the Bonded Logistics Park, simplify procedures, speed up goods flow and promote the development of a free port.	Qingdao Port, Tianjin Port
	Port Logistics "network layout" model	Solely or cooperatively construct cross-regional "Port Logistics Network".	HPH (Hutchison Port Holdings)
	Supply chain strategic alliance model	Construct a pool of interest, share resources, Co-specialization, and achieve technological innovation and diversification operation.	None

3 SC-Model of Port Logistics

The port SC-Model treats the port as a core, effectively integrates the various service suppliers (including handling, processing, transportation, warehousing, customs clearance, distribution, or even financial, business services companies, etc) and customers (including shippers and shipping companies, etc) into a whole, then delivers the correct number of goods to the right place at the right time. Its goal is to achieve the lowest cost throughout the supply chain. The members of this model are different from the traditional supply chain structure. According to the users' composition and business processes, the structure of the port supply chain this paper builds is showed in Figure 1.

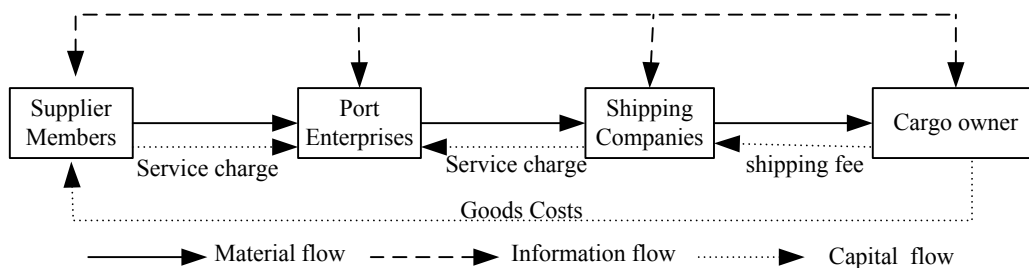


Figure 1 Structure of Port Supply Chain Model

The Figure 1 shows that the supply chain of port enterprises is a kind of serviceable supply chain. Compared with the manufacturing, port supply chain has no the create links. Its oriented core is a serviceable enterprise. This model also includes material flow, capital flow and information flow, but also has its own characteristics.

1) The type of enterprises is multifold and the span is large. Therefore, the complexity of port supply chain is high. The manufacturing supply chain is generally composed of suppliers, manufacturers, distributors and consumers. But the port supply chain includes suppliers (shippers), shipping companies, port enterprises, land transport companies, distributors, etc. This demonstrates the complexity of the port supply chain.

2) The direction of material flow is bidirectional. Since not only the goods flow into the port, but also the goods out, so in the entire network, material flow is not just a one-way direction, but the two-way. Information flow is interactive and the directions of capital flow show diversity.

3) This model has large uncertainties. In the port groups of the same region, the services different ports provide are growing to converge. Ports' functions tend to homogenized. So enterprises' choose make the operation of the port supply chain with more uncertainty. In addition, the port city's development orientation, the investment of economic hinterland and the scale effect of industry cluster will bring variables to the operation of port supply chain.

4) The integration of port supply chain is very difficult. Integration plays an important role in the SCM, but some integration technology of manufacturing does not apply to the port enterprise supply chain. Moreover, the node enterprises of port supply chain have large difference. Therefore, the integration and optimization of port supply chain will be more difficult.

4 The Development of Port SC-Model in China

With the deepening development of logistics and supply chain, the development of the world's major ports has gone through four phases: the first generation of "transport type" port; second generation "transport + service" port; third generation of the "logistics center model" port and the fourth generation of the "Supply Chain type" port. With the development of modern port, the port management concept has experienced a process that is from the cost idea to the profit idea then to the integrated logistics service concept. Then the port logistics gradually develop to enhance customer service and improve the logistics functions.

4.1 The main problems of port SC-Model development

At present, the development of port SC-Model in China is still in the initial stage. Compared with the foreign advanced port supply chain, a large gap also exists. Therefore, the port transportation costs, warehousing costs and management costs in China are higher. Moreover, there are some imperfect problems in the operation and management.

1) Lack of the systemic concept of supply chain and effective coordination mechanism. The links of port business with upstream and downstream enterprises are not close enough yet to establish a stable logistics alliance. At this stage, the scope of port logistics activities is limited. It has not established the stable strategic partnership between ports and related maritime transport, railways, highways and other large logistics companies. This will be difficult to achieve efficient and accurate logistics services, even the flexible connectivity. In addition, ports have fewer contacts with industrial enterprises and processing enterprises. The logistics alliance is not high and the good coordination mechanism also lack.

2) Efficiency of information transfers and the extent of share between node enterprises are low. The information about demand forecasting, inventory status and production planning of node enterprises is the important dates of supply chain. These dates are necessary to respond to user needs quickly and effectively. However, the information standardization is not uniform and the concepts among enterprises are different. So the upstream and downstream enterprises lack smooth connection of information.

3) High inventory costs. The inventory management of port enterprise is static and single-level. Port's inventory control policies have no links with suppliers' and shippers', so port can not use the resources of supply chain to achieve a joint inventory management, resulting in higher inventory cost of port.

4) Lack of logistics management and R & D (Research and Development) talents. The professionals of port logistics are extremely scarce. Moreover, there are lack of new interdisciplinary talents of proficiency in port logistics management and engineering.

4.2 The solution measures of port SC-Model development

The trend of port logistics is to build and improve the port logistics service supply chain whose leader is port enterprise. So, in order to improve the efficiency of port logistics, how to integrate and manage port service supply chain is the crucial issue. And emphasis and focus is to enhance the level of its management and operation. To solve the above problems, better develop the port SC-Model, and play its significant role, it requires joint efforts of all levels of society.

1) Full play the active and leading role of the government into port logistics, and enhance SCM concepts of enterprises. The government must not only guide enterprises, but also cultivate and support them actively. At the same time, the government intervention must adhere to the direction of market, and relax restrictions in the micro area as much as possible to provide more free space for enterprise operation. Furthermore, the government should conduct enterprises to realize the importance of SCM, and make publicity and encouragement.

2) Strengthen partnership among enterprises of port supply chain, and then establish the alliance of port logistics service supply chain. The number of members in port supply chain is large, and their sizes and natures are different. So the interest conflict among members is very obvious. Port should establish good partnership with other members of the supply chain, form communities of interest, and use the expanded resources and complementary strength to reduce the time and cost of the whole logistics process. So it can be achieved that maximizing the benefits of the global supply chain.

3) Set up the suitable coordination mechanism of port SC-Model. Coordination is not only a means of regulation, but also a function of management and control. In addition, it is also a state that shows a kind of harmonious relationship among subsystems, among the various system elements, among system functions or between structures and objectives. It can used to describe the overall effect of the system. The purpose of coordination is that making the information of meeting certain service quality to pass through the supply chain continuously and smoothly. Then the supply chain can respond to customer needs in real time. Coordination mechanisms of port supply chain include information coordination, logistics coordination, distribution of benefits coordination, resource coordination, and personnel training coordination, etc.

4) Set up the information mechanism of port SC-Model to enhance the information sharing. Information sharing plays an important role for coordinating a variety of factors of supply chain. It is helpful for making decisions of supply chain members. Thus the modern SCM requires members to share the following information: the business plan, forecast information, inventory information, purchasing information and logistics coordination information, etc. The implementation of information mechanism can be achieved with establishing the logistics information platform of port supply chain. This platform connects all relevant enterprises of port supply chain with Network Technology, Information Technology and Logistics Technology. It is a “virtual enterprise” of network that can achieve the collection, transmission, processing and analysis of information date, and then provide an open platform for members’ communication. This is not only the foundation to achieve the functions of port supply chain, but also the critical factor to improve the competitiveness of port supply chain. Users of the information platform include all the relevant enterprises and institutions of upstream and downstream. The functions cover every aspect of port operations. The structure of users and functions is showed in Figure 2.

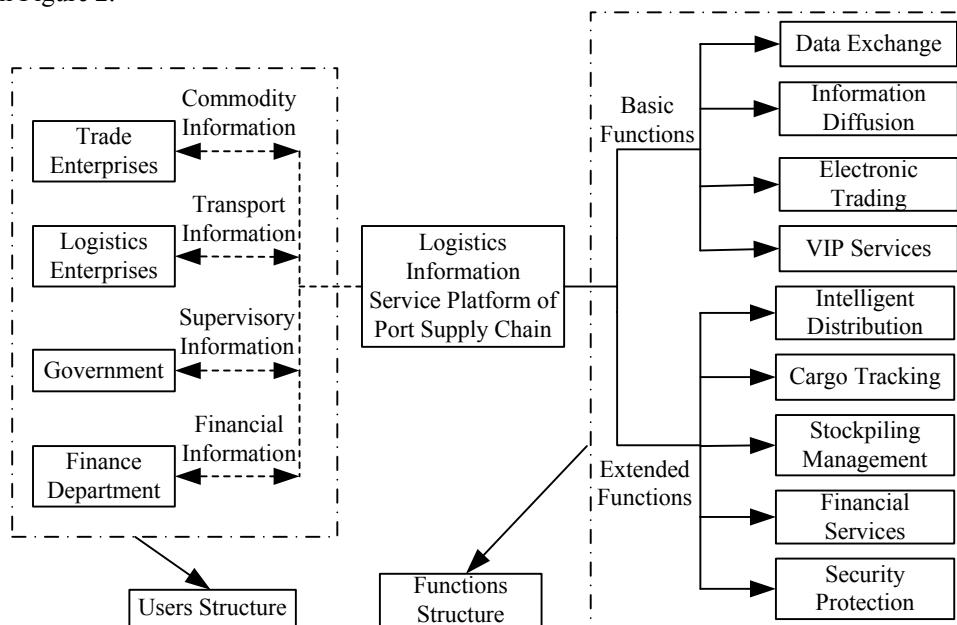


Figure 2 The Structure of Logistics Information Service Platform of Port Supply Chain

Figure 2 show that all the enterprises of supply chain can exchange their information through this platform. Therefore, the sharing can be achieved. Because port has the cluster effect and stronger competitive, it is the core of this platform. In the function setting, the platform not only includes basic information processing functions, but also some extended functions based on port characteristics, for example, intelligent distribution function, cargo tracking function with RFID (Radio Frequency Identification), stockpiling management function and financial service function. Each function has its own characteristics and target.

5) Strengthen personnel training and management. In view of the situation of the talent shortage, port logistics enterprises not only need to recruit talents in domestic and foreign markets, but also should take many other means, for example going out and inviting, to enhance the training of the existing personnel. Only the port's employees improve their own qualities constantly, and continuously learn and apply the advanced technology and methods, it can be achieved that building an appropriate supply chain of port logistics service.

5 Conclusion

The main work and conclusions are summarized as follows:

1) Analyzing and comparing the characteristics of a variety of port logistics development models. This paper shows that it is a trend for ports to select a model suited to their development. And the selection should be according to local conditions, the own conditions and characteristics of each model to make matching. Port should choose the most appropriate, rather than the most advanced.

2) Especially researching the port SC-Model, establishing an integrated structure of this model, and analyzing its features. SC-Model arises under the premise that SCM thinking develops more and more widely. It is a new development tool and has huge potential benefits for ports' development. And it is not independent of other models, but can be used as an aid that is applied with other models. It is conducive to the integration of port resources and enhancement of competitiveness.

3) Analyzing the problems of the current development of port SC-Model in China, and then putting forward the corresponding solutions. Development of port SC-Model requires both the macro support of government and the micro cooperation of enterprises. Only starting with the two aspects, the SC-Model can play the desired effects. For the port supply chain information mechanism, this paper establishes a common port logistics information platform, analyzes and describes its users and functions. This will be a direction of future researches.

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