Optimization Strategy of Port Supply Chain Integration in China

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ABSTRACT
Port supply chain is a chain-type network structure that realizes efficient transfer of goods, capital and information at the lowest possible cost through information technology. The downturn in the shipping industry since the financial crisis has put pressure on all sides of the supply chain. The purpose of this paper is to put forward the corresponding optimization strategy according to the operation of port supply chain. Firstly, this paper summarizes the characteristics of port supply chain from the actual operating situation in China and puts forward that the future development needs to improve data transparency as well as the market competitiveness and vitality from the theoretical perspective. Secondly, it discusses the low efficiency caused by data problems in operation and the loss of benefits caused by competition among enterprises. Finally, this paper draws a conclusion that the operation of port supply chain can be optimized by building an information platform to improve operational efficiency through blockchian technology and increasing the engagement of government oversight agencies.

Keywords: *Port supply chain, Cooperation strategy, Blockchain.*

1. INTRODUCTION

The port is increasingly connected with transportation networks and embedded into supply chains in multiple regions as the role of it changes from a gateway to a logistics hub [1]. Castells (1996) [2] mentioned that science and technology enhances the importance of information in the society, and pointed out that the connection among people, goods, capital and information flows generates a network society, and the port is the hub and key infrastructure for the convergence of multiple flows. Carlan et al. showed that digital innovation is a new trend in the shipping and ports sector [3]. The port supply chain participants at all levels have independent interests demand. In order to maximize the benefits, they tend to give priority to their own profits and pass on the management risk. This will not only harm the interests of the other parties in the port supply chain, but also destroy the stability of the port supply chain structure and hinder the realization of the maximization of the overall interests of the port supply chain [4]. This paper explores important issues including how to construct and optimize the port supply chain, how to improve the efficiency and overall benefits of the supply chain, how to promote the win-win cooperation between port and shipping enterprises, and what the impact of port supply chain integration is on improving the competitiveness of port and shipping enterprises. This study is beneficial to the improvement of the competitiveness, operational efficiency, and sustainable development of port supply chain. It provides suggestions and references for the operation in market competition.

2. MARITIME SUPPLY CHAIN

Maritime supply chain (MSC) has a broad sense and a narrow sense, both of which are network chain structures composed of upstream and downstream enterprises in order to realize an efficient operation of logistics, information flow and capital flow. The difference between the two senses is reflected in that the capital flow of the narrow supply chain only refers to the direct capital flows generated by the daily operation of the member enterprises of the supply chain, while the indirect flows generated by borrowing from financial institutions are also included in the broad supply chain.

Different from the traditional manufacturing supply chain with model and specification inheritance, port supply chain enterprises do not create new commodity entities. Instead, they realize the flow of goods, being accompanied by auxiliary logistics services. By comparing the specialized service supply chain with

special industry thresholds, many studies believe that MSC not only has the characteristics of being a service-oriented supply chain, but also possesses other unique characteristics, such as complexity, integrity, variability, virtuality, and difficulty in coordination [5]. Port supply chain cooperation is contractual, changeable and fragile. Supply chain enterprises directly communicate with customers through virtual Internet tools, and customers can decide the cooperative relationship with supply chain enterprises according to risk preference, market environment, service quality, service efficiency, and other factors [4].

From the perspective of the supply chain management theory, Pioriel and Quinn (2004) [6] developed a maturity model of a five-stage supply chain (shown in Figure 1), demonstrating the transition from enterprise inheritance to full network connectivity. At present, many stakeholders of the port supply chain have reached the second stage. What greatly limits the occurrence and development of maritime supply chain cooperation between the response speed and service level of the industry is that a lot of companies lack the motivation to cooperate and aim at reducing their own costs so as to improve viability. If barriers are to be crossed to enter the stage 3, 4 and 5, greater end-to-end visibility and transparency will be needed, and at the same time, regulators will also need to play an important role in creating a fair, innovative, sustainable and competitive market.

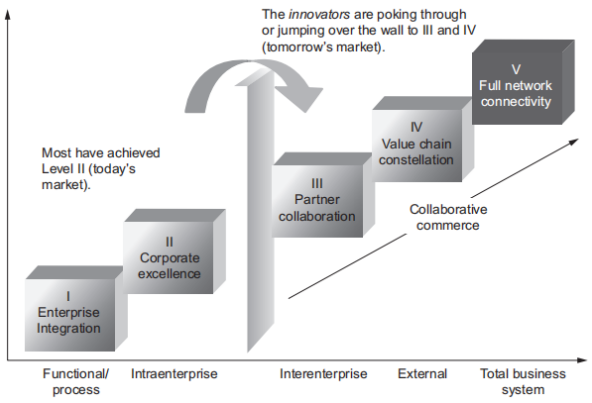

Figure 1 Supply chain maturity model [6].

3. PROBLEMS IN OPERATION

3.1 Inefficiencies caused by data problems

The inefficiency of port supply chain is related to electronic data interchange (EDI) practice. With the development of information technology, supply chain enterprises usually choose separate ICT to solve the internal problems of the company. Different software and different information systems check and spread among different application permissions, resulting in poor data transmission and data redundancy.

The research of Carlan et al. [7] shows that when facing the challenge of data retrieval, supply chain stakeholders usually adopt contemporary solutions that process data manually (such as sending, processing or receiving data related to supply chain capital flow, goods flow and information flow). As a result, inefficiency is caused by incomplete information, data input errors, increased costs, network risks and other problems.

In terms of information flow, serious information asymmetry will lead to low efficiency. For hundreds of years, traditional supply chain of shipping trade seriously relies on the intermediary structure (e.g., freight forwarders, financial institutions, etc.) to carry on the exchange. In addition, although the electronic data interchange (EDI) process has been included in the shipping of the supply chain in the digital, but MSC in financial institutions is still mainly based on the traditional paper-based documents (b/l, l/c, etc.) and this has caused slow speed, high cost, and labor intensive [8]. At the same time, differences in technology and management barriers among the relevant subjects of supply chain finance are not conducive to tracking, operational planning and relevant data retrieval process. Financial institutions can only depends on the core enterprise credit to carry out credit granting activities for some upstream and downstream users, which limits the development of supply chain finance [9].

The low efficiency and high cost of information acquisition also lead to the lag of effective information and data, and all parties in the supply chain fail to timely identify and respond to potential risks due to information asymmetry, resulting in losses.

3.2 The loss of benefits due to competition

Competition and cooperation will affect the operational efficiency of port supply chain and lead to loss of interests. Port supply chain enterprises compete in order to maintain or improve their own interests, not only with horizontal competition, but also with vertical competition [4].

Horizontal competition refers to the competition in the form of low price promotion among port enterprises that are in the same value link and provide the same logistic service, such as competition and cooperation between ports within the port group, etc.

Vertical competition refers to the competition relationship between upstream and downstream port and shipping enterprises (such as ports and shipping companies, land transport service providers and freight forwarders) that are in different value links and have direct operation sequence, such as the expenses incurred at the connection of various logistics nodes [10].

Because natural resources (coal, natural gas, oil, etc.) are unevenly distributed in the north and south of China

and are usually transported by shipping, more and more rivers and coastlines are developed to capture more and more market share, causing the docks expansion and port capacity surplus. The supply situation goes from shortage to oversupply. Some ports use price wars to secure supplies in this circumstance, transferring profits to source enterprises and causing the weak profitability of ports, which is an unsustainable practice. At the same time, backward information technology and obsolete management mode also make it difficult for the port to establish long-term cooperative relations with other supply chain enterprises.

Besides, core enterprises' logistics process is generally the key value-added links in the supply chain network link. Under the condition of an increasing port supply chain effect, the relationship between more and more supply chain enterprises turns from cooperation to competition. Monopolies or enterprises with a strong bargaining power in practice tend to break the interests distribution rule, and withdraw form the cooperation at will to maximize their own interests. It affects the overall efficiency and stability of the supply chain, and this trend also increases the financial and market risks of other enterprises.

4. OPTIMIZATION STRATEGY

4.1 Blockchain optimization of port supply chain

Digital innovation is a new trend in the maritime and port sectors. Because the port supply chain depends on the material flow to realize value-added services, and there is no ordering information transmission, the response speed of the downstream customers is extremely important. In order to shorten the waiting time of customers as much as possible, there is a need to rely on the construct information communication platform to share information, so as to realize each node of enterprises in supply chain collaboration, finished goods and information flow. When using ICT tools to integrate MSC, originators of blockchain applications face barriers due to market competition, capital constraints, lack of regulation, etc. Carlan et al. classify these barriers into four categories, namely economic barriers, legal (regulatory) barriers, political, technical, and cultural barriers, and managerial barriers [1].

The use of blockchain can play a key role in solving specific problems in a particular environment. The essence of blockchain is a decentralized and automated innovation platform that facilitates further integration of the maritime supply chain. Participants in the network platform can leverage operational efficiency, available assets and their own competitiveness to develop enterprise bilateral cooperation into many-to-many offshore supply networks. But blockchain cannot solve all the problems, such as IT-related problems caused by slow digitization. Studies show that the biggest sources of resistance to the implementation of blockchain applications are non-technical factors such as the trust problem between enterprises and people's resistance to change. People still place a higher degree of trust in intermediaries and paper solution, whereas the blockchain technology simply delegates the "trust" in third parties to algorithms.

Due to the need for timely, reliable and accurate information from multiple parties, managing and integrating a database using applications such as blockchain may be one way to solve data problems. Through different sources of data, the supply chain enterprises can build partnership by algorithms, and can find potential partners to reduce the transaction costs associated with strategic matching. Freight forwarding and logistics service providers have more chances to handle customer problems and exceptions. Docks and freight companies can also improve the efficiency in operation and management. The shipper can reduce their working capital as well as avoid the high cost on one-to-one EDI connection, which not only is conducive to breaking the monopoly and monetization of data, but also can realize information sharing through ICT and therefore promote further integration, eliminate the inefficiency of paper-based logistics, information flow and capital flow, and bring competitive advantages to the community [3].

4.2 Enhancing regulation to promote cooperation

The alliance cooperation between industry is also crucial because many enterprises in the supply chain show a negative attitude in collaboration with others, which happens to the detriment of the trust among supply chain enterprises and the maintenance of a good supply chain system. The government should play an important role in creating a fair and stable business environment. Firstly, to prevent data monopolies or other types of abuse, policymakers need to formulate relevant data management rules, regulate the data domain, and establish and update data governance, security and privacy models.

The government also needs to formulate regulatory measures, promotes the cooperation among port supply chain parties indirectly, encourage enterprises to give a full play to their creativity and initiative in cooperation, and jointly develop the advanced information technology applications (such as forecast analysis, transducer, etc.). This is beneficial for enterprises to make better strategic decisions, improve their operation, save costs and practice, as well as forming, maintaining and strengthening their own core competitiveness with the help of other enterprises' core competitiveness. It is also helpful in improving customer satisfaction, maximizing the value created by port supply chain, and establishing

new competitive advantages in the future of global shipping.

At the same time, regulators also need to develop certain rewards and punishment mechanism to standardize the cooperation, imposing penalties on those who withdraw cooperation during the course, restricting partners from terminating cooperation before the expiration, and making up lost time to those who do not withdraw through paying compensation. It will make the port supply chain profit distribution process more reliable and fair, improve the trust of the stakeholders, encourage the institutionalization of cooperation, expand short-term matching, and produce long-term cooperation, because the costs of new partnerships may exceed companies' additional efficiency gains, while long-term cooperation will maximize the return on investment of enterprises and reduce additional transaction costs.

From the perspective of sustainable development, government departments also need to increase support for innovation through public funding and other methods, innovating and developing a sustainable business model.

5. CONCLUSION

This article carries on the analysis about the present situation of port supply chain operation, and points out that the data redundancy and asymmetric information lead to low efficiency, which can be eased through the information platform constructed by block chain technology, thus achieving a timely, reliable, and accurate information flow as well as breaking the monopoly and monetization of data. Advanced digital technologies bring better connectivity and visibility to platform members, effectively responding to the changing balance of supply and demand.

For the non-technical factors that cannot be solved by blockchain, such as the loss of interests caused by competition among port supply chain enterprises, and trust problems and resistance to change among stakeholders. It is necessary to formulate relevant measures through the regulatory authorities' efforts, introduce incentives and penalties to regulate the cooperation relationship, and establish a fair and stable business environment. At the same time, policy makers also need to increase policy-type support for innovation collaboration from the perspective of sustainable development as well as promoting the development of new business models for global maritime supply chains.

The paper lacks the actual operation data of a certain port, which needs to be further improved. Meanwhile, the research object is the port enterprise only, and does not involve the integration of various individual supply chains (such as container supply chain, etc.). In the future, the research can be carried out on specific port supply chains.

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