A Study on the Collaborative Mechanism Based on Cost Control Theory in Coastal Harbor Logistics

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Abstract. Under the increasingly stable state of both the transaction scale of foreign trade business and the throughput, the collaborative development among the coastal harbor and regional economy has become the crucial way for competence improvement. This paper showed through empirical study that the harbor logistics shall have the positive correlation with the development of regional economy, thus based on the perspective of cost control study, this paper objectively analyzed the practical problems existed among the logistics operation of coastal harbor in China, established the logistics collaborative operation mode in strategical, business, information and fund interface, and proposed the policy suggestion to reduce the logistic cost from the two dimensions of the local government and coastal harbor, so as to benefit the development of regional economy.

Introduction

The harbor throughput of China has occupied the important share around the world, bearing the custom clearance and distribution work for plenty of domestic trade transportation, foreign trade goods delivery and the bulk stocks such as petrochemicals and iron ores, this closely connected with the development of national economy. Although the harbor throughput of China has got great development, but in comparison with the harbor in European countries and the US, there still existed a great gap in both the management level and service capability accordingly. Especially the logistic supply capacity of the harbor was fallen behind the harbor growth, and didn’t meet the demand of the rapid growth of harbor in China. Based on above factors, this paper analyzed the relations between coastal harbor and regional economy as well as the main problems facing harbor logistics cost control, explored the construction of the harbor logistics collaborative operation mechanism, and then proposed the opinion and suggestion for optimization of harbor logistic operation accordingly.

The Analysis on the Relationship Between Coastal Harbor Logistics and the Development of Regional Economy.

The Index Selection and Data Origin

The coastal harbor logistics refers to the supply chain service to accomplish the whole goods sales process such as goods transportation, storage, distribution, processing and re-packaging, packaging, custom clearance, commodity inspection, insurance and information exchange etc by taking the harbor transportation and transition as the main functions.[1] However, for the statistical materials related to harbor logistics, till now there still not formed the systematical and unified system domestically. Therefore, to select the index that could represent the harbor logistics development status shall be very important. From the harbor function, to select the cargo throughput of port (PCN) as the representative index for harbor logistics can fully reflect the position that the harbor have had among the national economy and social development, and it can also reflect the harbor scale and its production capability even well. As per the regional economy development index, to select the gross domestic product (GDP) as the representative shall have the matching authority and it can also get the wide recognition then. Based on above opinions, by taking the two time series in the gross domestic product of Zhejiang Province from 1994 to 2014 (GDP, in RMB 100 million) and the cargo
throughput of port (PCN, 10 thousand tons) as the sample, this paper made the empirical analysis on the relationship between the harbor logistics in Zhejiang and the development of regional economy of Zhejiang, by eliminating the price factor of both above series, to convert these into the constant price. In order to reduce the heteroscedasticity, the PCN and GDP were also treated through the natural logarithmic transformation and remarked them as LNPCN and LNGDP respectively; after the transformation the co-integration relationship of the original time series was not influenced at all, by using the double variant trend variation diagram drawn Eviews, it was shown that both the two factors has the similar trend of growth and change, this implied that there may be the co-integration relationship between the two factors.

Econometric Method

The main econometric method in this paper is the vector auto-regression model (VAR). The VAR model is such a model established on the basis of statistical property of the data, by taking each endogenous variable in the system as the function for the lagged values of all the endogenous variables in the system it structured the model, so as to expand the single variant auto-regression model to the vector auto-regression model consisted by the variables of multivariate time series. The VAR(P) model shall have the general mathematical expression as:

$$Y_t = A_1 Y_{t-1} + \cdots + A_p Y_{t-p} + B X_t + \epsilon_t$$

There, the matrix $A_1$ in $\epsilon_t$ $1 \times k$ dimension , $\cdots$, $A_p$ and the matrix $B$ in $k \times d$ dimension are the coefficient matrix need to be estimated. $\epsilon_t$ is the disturbance variable in $k$ dimension, they shall have the simultaneous correlation with each other, but have not the correlation with its own lagged value, also have the correlation with the variables on the right side of the inequality.

Based on the VAR model analysis, this paper did analyze the relationship between the harbor logistics and regional economic development by using the Granger causality test and co-integration analysis method. Firstly the unit root test was used on the cargo throughput of port and gross domestic product, then the Granger causality test was used for determining the relationship of above two factors, finally the discussion on whether there’s short term or long-term equilibrium relationship existed between the two factors was made accordingly. The regression and test process were all performed by the econometric software Eviews 5.0.

Establishment of VAR Model and co-Integration Relationship Test

To use the Eviews software for estimation of the VAR Model, through experiment the VAR model got the optimal value while the lagged order number is 3. The VAR model is given as below:

$$\text{LNPCN} = 1.461 \text{LNGDP}_t - 1 - 2.103 \text{LNGDP}_{t-2} + 0.852 \text{LNGDP}_{t-3} + 1.068 \text{LNPCN}_t - 1 - 0.215 \text{LNPCN}_{t-2} + 0.014 \text{LNPCN}_{t-3} - 0.185$$

While $R^2=0.9962$, adjusting $R^2=0.9948$, S.E.=0.0595, F=668.6880, it showed that the model shall have the satisfactory statistical results. All the reciprocal of the estimated root model in the VAR model is less than 1, it implied that the estimated VAR model shall be stable.

From the co-integration equation it can be seen that, during 1994 to 2014 there is the long-term stable relationship existed between the cargo throughput of port in Zhejiang and the gross domestic product. The coefficient in the model is positive, implying that the economic development shall have the positive correlation with the cargo throughput of the port.

The Analysis on the Problems Existed in Coastal Harbor Logistic Operation

The Individual Operation of the Coastal Harbors Lacks of Competitive Advantage

The traditional coastal harbors are basically large major state-owned enterprises, and most of them are governed in different province separately without the subordinate relation, and their operation is
also separately performed, with lower integration level of the resource, which in turn resulted in the even higher logistic cost and the cannibalization effect to the enterprises. Against the background such as economic globalization, trend of larger-sized vessel, federalization of corporate management, the increasingly fierce competition in the world shipping market, the complete recovery of export-oriented economy and the successful transformation and upgrade of regional economy shall still need more time, these will bring more severe challenges to the harbor enterprises accordingly. How to improve their own competence through reducing logistic cost under such situation has already become the hard issue that Chinese harbor enterprises need to solve urgently.

The Traditional Logistic Operation Mode Led to the Lower Efficiency

In the logistic operation links such as discharge, transportation and storage etc, the coastal harbor enterprises have realized the modernization of the hardware equipment with the higher degree of mechanization. But on the software especially the construction of informatization, they have had still the deficiencies accordingly. Although many harbor enterprises has established the logistic information platform, there are few modules to realize the real-time operation. The harbor enterprises were still not incorporated in the supply chain, and they did also not form the shard information and real-time interaction with the enterprises upstream and downstream, thus cannot respond to market demand quickly. The harbor enterprises still need the continuous reform and exploration for improving the configuration capability on both international shipping and financial resources, optimizing the port structure and management structure of the harbor, cultivating the new point of economic growth and the growth pole of goods source.

The Cost Strategy Has Yet to be Fully Established in the Harbor Enterprises

Due to the double restraints of the nationalization and administrative subordinate, although some harbor enterprises has got the certain economic benefits based on the policy bonus and the periodical characteristic of regional economic development, but the egalitarian practice still existed, and they have not felt the pressure of market competition. The management means on the logistic cost of many harbor enterprises are also depending on the main body of mission type based on administrative command, throughout all the beginnings and ends of corporate logistic cost control procedure, their grassroots employees did not have the cost consciousness and are lack of the enthusiasm on cost control. The enterprises have got used to paying attention to visible costs such as discharge fees, materials fees and energy consumption charges etc, and they paid little attention to the invisible costs such as the capacity utilization rate, etc. The enterprises did not have the sustainable control means on the logistic cost, and the cost monitoring links still call for improvement.

The Establishment of the Collaborative Operation Mechanism in Coastal Harbor Logistic Enterprises.

Based on the research of domestic scholars, through expert interview, by field research on Ningbo Port Company Limited, Zhoushan Port Company Limited, this paper proposed that the collaborative operation of coastal harbor logistic enterprise can be divided into four interfaces: the collaboration through strategical interface, business interface, information interface and fund interface.

The Collaboration through Strategical Interface

Through establishing the strategic alliance with the cooperative enterprises upstream and downstream, the harbor enterprises shall set up the confidence mechanism, to integrate the dispersed resources organically through the working mechanism of sharing benefits and bearing risks mutually, while reducing the logistic cost to realize the collaborative effect as 1+1>2. [2]Through the system design and treaty rules of the alliance, it shall fully implement the cost controlling thought of the whole process, all staff participation idea, the concept of competition and saving into each cooperative entity and operation link among the alliance, enable each cooperative entity having the
complementary advantages, unified action and mutual target. The collaboration through strategical interface can be divided in different hierarchies, the compact strategical alliance based on equity relation shall be constructed among the core enterprises, the network strategical alliance based on benefit chain and the contractual relationship shall be constructed among the key enterprises and the loosen strategical alliance based on the value identity shall be constructed among the affiliated enterprises.

**The Collaboration through Business Interface**

To optimize the operation process, expand service range, construct the logistic business chain and service chain that integrated the loading and discharging, transportation, storage, processing, dispatching, distribution, payment collection etc together. To precisely judge the internal and external environment of the enterprise and the resource advantages, through implementation of river-ocean combined transportation, railway-water combined transportation, port-railway combined transportation methods to realize the integration and optimization of logistic resources, reduce logistic cost. To carry out the standardization project of operation, to plan the operation standard of the strategical partner in unification, formulate the logistic collaborative operation manual, regularly organize the staff training for the partner, realize the standardization of executive instruction, business process, operating tools, promote the seamless joint between the operating tools of cooperative enterprises (such as the vehicle specifications for container loading, specs of discharging tools, the dimensions of automation feeder platform, etc), to improve the use efficiency and benefits of the operating tools.

**The Collaboration through Information Interface**

Base on the big data concept, through perfecting the collaborative logistic information system, to conduct the reasonable order optimization, through the one-stop service to find out the optimal transportation route and optimal distribution scheme, to offer the solution with lower cost to the largest extent, realize the optimized configuration of the distribution method, so as to reduce logistic cost and improve the distribution effectiveness radically. Based on the demand for reducing logistic operation cost, the communication mechanism of regular executive meeting, information exchange and communication, scientific innovation exchange shall be established between harbor enterprise and partner, so as to realize the information symmetry and resources sharing among the partners, increase the transparency of logistic collaborative operation, improve the confidence among the partners.

**The Collaboration through Fund Interface**

Through the communication and cooperation with relative financial institutions and intermediary institutions, the harbor enterprise shall innovate the fund payment method among logistic operation link, expand the applicable range of electric payment, improve the frequency and efficiency of fund circulation, so as to accelerate the progress of logistic collaborative operation among the partners then. In addition, through collaboration via fund interface, the harbor enterprises may expand their financing channel, to provide the derived value-adding service through investment on port shipping enterprise and the third party logistic enterprise, expand the logistic business scope and reduce logistic operation cost.

To summarize above analysis, this paper proposed the conceptual model for the collaborative operation mechanism in the coastal harbor logistic enterprise, as per shown in figure 1.
Figure 1. The conceptual model for the collaborative operation mechanism in coastal harbor logistic.

**Conclusion and Policy Suggestion**

Chinese coastal harbors need to transform from the traditional “loading and discharging” port into the modern “logistic-trade” port. [3] The transformation and upgrade and the sustainable development of the enterprises shall inevitably require the reconstruction of logistic service system, by focusing on the reduction of logistic cost, carrying out the overall reconstruction of logistic technology, logistic method and logistic ideas to establish the new operation mode and operating system accordingly. Both the local government and coastal harbor enterprises shall actively make the innovation on the aspects of concept, operating policies and operation modes etc, to adapt to environmental changes, by performing the collaborative operation through the interface of strategy, business, information and fund etc, for this reason to effectively integrate the resources, optimize operational mechanism, promote all kinds of transportation methods and the effective connection and configuration among various transport capacities, so as to improve the operational effectiveness and efficiency of the enterprises.

On the government level: 1. To further reinforce the governmental policy support. The government authorities shall pay high attention to the issue of coastal harbor logistic cost saving, for the industrial development concerned to national interest and people’s livelihood are all related to the harbor enterprises closely. The local governmental authorities shall encourage and support the excellent and powerful enterprises by giving administrative commands or system design according to the demand of regional industry development, support the construction of the coastal harbor especially in the hub-like harbor, to make the aspects such as taxation policy, approval procedure, business qualification etc biased to the key port and its affiliated enterprises related to logistic business, to break through the obstruction of the collaborative operation among the coastal harbor and transport enterprises, support both the two parties to move in same direction and develop mutually, further reduce the logistic cost of the cooperative parties and improve the competence of harbor enterprise. 2. To establish the regional logistic strategical collaboration mechanism. First to plan and design the strategical layout of the port logistic, by surrounding the new point for economic growth, new engine for industrial increase, new industrial agglomeration, new metropolis circle and new trade pattern of the state during the “thirteenth five-years plan” period, to construct the new model and running mechanism for the harbor logistic operation that meet the demand - such as by surrounding the need of national One-belt-one-road strategy and the strategical emerging industries the country focused on the development, to accelerate the construction of intersection between the “Silk road economic belt” and “silk road on the sea”, to set up the comprehensive pilot zone of ocean-railway combined transportation etc, to integrate the links of logistic transportation, storage and distribution etc as the “one package” service, to develop the transportation routes in new type and carry out the railway express business of international LCL container from the harbor enterprise to the middle/ west Asia and the Europe. The second is that, under the unified guidance of national macro policy, based on the concept of win-win cooperation and mutual survival and development, the local government in adjacent region shall completely set up the strategical partnership and improve the competence of the enterprise. For example the Shanghai and Ningbo regions are both located in the economic circle of
the Yangtze River Delta, the Ningbo Port shall combine with the Zhoushan Port to make collaborative operation with Shanghai Port, to perform the function positioning at the base of deep water port and international shipping center by surrounding the development strategy of Shanghai Port. Through cooperation with Shanghai Port to promote the quality of their business development and expand their service range, also improve the global allocation ability and operation efficiency on international shipping and financial resources, cultivate the new growth point of economy and growth pole of cargo source. 3. To perfect the infrastructure of the backbone railway network, branch line network and container yard network among the harbor enterprise and each main node city inside the economic circle region, to lay a solid foundation for the smooth promotion of the river-ocean combined transportation, port-railway combined transportation and railway-water combined transportation. For example, to accelerate the promotion for the land transport network construction among the Ningbo Port, Zhoushan Port and Shanghai Port, the construction for the project of inland canal dredging within the ring of Hangzhou Bay metropolitan area, the construction for the railway-water transport transition network of inland cities, etc.

On the port level: 1. to fully promote the port scientific innovation strategy. The port logistic operation efficiency and effectiveness should be improved through the scientific and technological innovation. On one hand, through developing the logistic information service platform based on big data, to update the demand-supply status of logistic enterprise in time, accurately position the demand rule of logistic enterprise, and also provide the needed market and decision-making information for the user. Through construction of informatization to drive the refined port logistic operation, so that to integrate and utilize corporate resources effectively, to improve the comprehensive capacity for all-weather access, fast loading and discharging, custom clearance, container decentralization, storage and distribution etc, enhance operation effectiveness and efficiency. On the other hand, through technical transformation to accelerate the promotion of harbor enterprise’s logistic operation mechanical tools upgrading and improve the logistic operation efficiency. 2. To practically optimize the cultivation environment of logistic talent. The key point to promote the scientific and technological innovation is the talent, to enhance the quality of practitioner in harbor logistics shall be the foundation to provide the quality logistic service. The first one is that through the establishment of teach-help-drive mechanism. To organize and held the business training course, theme saloon etc, so as to improve the business capability of the practitioner in logistics, create a batch of technical experts. The second is to select the young staff with excellent business ability and quite good political quality from the enterprise for further education in college logistics specialty, to improve the theoretical level and R & D ability of the technicians. The third is to actively design some logistic operation items and arrange some young technical talents as the person in charge, to provide the logistic talent with the exercise chance and the stage for showing their capability. 3. To continuously strengthen the cost strategical consciousness, the harbor enterprise should incorporate the cost strategy into corporate management strategical system, actively build up the consciousness of cost saving with enthusiasm, through the methods such as the system design, organizing large activity, innovating managerial mechanism etc to cultivate the cultural circumstance with cost saving, to put the cost strategy throughout each operational link of the enterprise, the enterprise shall pay attention to the demonstration effect of the leadership, motivate the grass-root employee’s sense of ownership, enable it becoming the habitual behavior of the staff in each hierarchy, so that naturally reduce the corporate logistic cost.
References

