Construction and Management of Cold Chain Logistics of Maritime Silk Route

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Abstract. As an important channel of cold chain logistics, the Maritime Silk Road is an important way to transport cold chain goods. In view of the characteristics of perishable cold chain goods, stringent time requirement and high difficulty in quality control, this paper expounds the process and links and requirements of sea transportation of cold chain goods from a systematic perspective, and analyses the significance and difficulties of building cold chain logistics corridor. On the basis of this, the measures of cold chain logistics channel construction are put forward from five aspects. In addition to strengthening communication and cooperation among carriers, shippers and consignees of the cold chain, vigorously developing professional refrigerated container business, comprehensively promoting quality monitoring and management of the cold chain, and using various advanced technical means are also effective measures to promote the construction of the Marine Silk Road.

Introduction

The "Maritime Silk Road" is an important channel for trade and cultural exchanges between ancient China and its neighbors [1]. Since its opening in the Qin and Han Dynasties, it has been an important bridge for economic and cultural exchanges between the East and the West [2]. Undoubtedly, the rebuilding of "Maritime Silk Road" will be endowed with new connotation and historical significance. The strategic partners of the Maritime Silk Road in the 21st century include not only ASEAN, but also point-to-point, line-to-line and area-to-area exchanges with border countries and regions, to link up market chains connecting ASEAN, South Asia, West Asia, North Africa, Europe and other major economic sectors, and to develop strategic cooperative economies oriented to the South China Sea, the Pacific Ocean and the Indian Ocean [3-6]. Belt, take Asia, Europe and Africa economic and trade integration as the long-term goal of development.

Establishing an economic region of Maritime Silk Route bring new opportunities for China and the whole world in 21st Century, which is also regarded as the major strategy of adapting our country to the new circumstances of economic globalization and broadening the joint points of common interests between China and various countries and regions, as well as, important initiatives to construct the new system of open economy [7].

Characteristics and Requirements of Cold Chain Logistics

Cold chain logistics is an important channel for Maritime Silk Route. And maritime transportation has also become an important choice for the transportation of cold-chain goods.

Objects and Application Scope of Cold Chain Logistics

Cold chain logistics refers to a systematic engineering that refrigerated food is always in a prescribed low temperature environment in the production, storage, transportation, sales and all links before consumption, in order to ensure food quality and reduce food consumption. Its requirements are relatively high, and the corresponding investment in management and capital is also greater than that of ordinary normal temperature logistics [8].
Cold chain logistics has a wide range of applications, including primary agricultural products (vegetables, fruits; meat, poultry, eggs; aquatic products, flower products) processed food, as well as special commodities - medicines [9]. Compared with the general normal temperature logistics system, cold chain logistics requires higher and more complex requirements, and construction investment is also much larger [10]. The timeliness requirement determines that each link of the cold chain needs to have a higher organizational coordination [11].

The temperature control of cold chain items includes active refrigeration and passive refrigeration [12]. The former refers to refrigerators, refrigerated trucks, refrigerators, refrigerators and other facilities [13]. The latter is through refrigerators (such as dry ice, blue ice, water ice, etc.), cold chain packaging boxes, heat insulation devices (insulation blankets, insulation cover) and so on [14].

**Maritime Transportation of Cold Chain Goods**

The whole process of maritime transportation includes five basic links: delivery, ground transportation, waterway transportation, arrival service and receipt [15]. There are three main bodies involved: shipper, carrier and consignee [16]. Most of the long-distance transportation is carried out by freight forwarders. From the delivery of cold-chain goods by the shipper, from the Forwarder at the origin to the customs, as well as maritime transport, carrier and other links, to the final receipt of goods, there are many "checkpoints" and complicated operation procedures [17]. Cold chain goods are a kind of transport objects which are sensitive to time and require a high level of demand [18]. Therefore, it is needed to get a high degree of cooperation and effective convergence of all links. It is absolutely important to conduct a comprehensive management of cold chain transportation from a systematic perspective, as shown in Fig. 1.

![Comprehensive Management from System Perspective](image)

**Figure 1. Comprehensive Management of Cold Chain Transportation.**

In recent years, with its fast turnover, refrigerated containers can achieve the advantages of "door-to-door" and small-batch refrigerated cargo transport, which occupies most of the port-to-port cargo transport business [19]. With the increase of domestic trade routes and the improvement of the whole-journey intermodal transport, the development of refrigerated containers has been promoted [20]. Transport of large quantities of frozen and refrigerated goods is more time-effective; support intermodal transport mode, can provide "door-to-door service"; professional refrigerated container cold chain transport, product quality is more reliable; more shifts, greater selectivity; land-sea intermodal transport, lower transport costs [21]. At the same time, with the development of
electronic technology and network technology, it can realize the inquiry of frequencies in the cold chain of maritime transport, make arrangements in advance, and search the goods online in real time, so as to make sure [22,23].

**Construction of Cold Chain Channel of Maritime Silk Route**

**Significance for the Construction of Cold Chain Logistics Channel**

For the service bearers of cold chain logistics (also known as perishable goods), the international markets is expanding at a sustained growth, which is even faster than many other kinds of merchandises, and a lot of innovations on technology and services have been made, though meanwhile risks and challenges are still existing [24]. When the fruits were harvested, food was produced and the flowers were picked, lots of losses are still suffering. According to expert analysis, nearly half of the food corruption occurred in periods of harvesting, producing and processing, and one fifth of them will be disposed due to the unavailability for sale and circulation [25]. There are lots of reasons that may lead to the interruptions of cold chain, which conduct the deterioration of perishable products, such as lacking of expertise, errors occurred in the convergence that engaging different modes of transport, (for example: refrigerated containers may be placed in a port or at an airport unplugged), or the monitoring may be not that closely.

At the phase of maritime transport in cold chain logistics, considerable long journey is going to be made, that is meant to be taken great risk. Nowadays, the proportion of refrigerated goods, which are shipped in containers worldwide, is up to 65%. And the shortage in specified equipments is causing much stress for the shippers and consignees in some trade routes, regions and ports. If cargos are not loaded or have been postponed to the next voyage, their life cycle may be cut down and experience a rising damage rate, which make circumstances of cold chain logistics more complicate and serious.

**Competition between Shipping Cold Chain Channel and Air Cold Chain Transport**

Competition brought by air transport is considered as one of the problems that faced by cold chain when constructing the channel of maritime silk route.

There is no doubt that drugs, especially the urgent needed ones, or so-called "high-value" merchandises such as vaccines, organs, blood, which are particularly stringent on timeliness, air transport would be their first choice. However, for most other cold-chain cargos, shipping is occupying a much broader market.

In recent years, refrigerated cargos which were transported by air accounts for only 5% of that were transported by container shipping. And since 2000, the amount of shipped perishable products was experiencing an average annual growth rate at 9.8%, nearly five timed that of air freighted (2.1%). During the economic recession in 2009, refrigerated goods freighted by air encountered a slide of 15%, while that number on shipping is only 3%.

It is noteworthy that there are no real constraints for air freighting capacity of perishable products [26]. Essential characteristics and distribution patterns of the refrigerated cargos are indicating that air transport may increase at a relatively modest speed. The industry of refrigerated cargo air freighting has to sever for the freight of fresh products and an already developed market. While, more people choose to believe that proportion of air freight made up in international trade is going to decline in the future, and the shipping freight market may still presenting a sustainable growth. From where the retailers stand, imported fresh foods must be packaged by specific materials. On one hand, these foods should be physically protected, on the other hand, customers have to be shown and informed that these foods were air freighted and value for the expenses. However, the advancing of e-commerce is pushing the traditional supply chain model out of the way, which means the "exporter- importer- wholesaler- retailer" mode is going to be replaced. Mode of "direct sourcing" and "direct sale" is making air freighting less worthy, then shipping comes to be a more reasonable choice.
Measures of Cold Chain Logistics Channel Construction

Strengthening the construction of cold chain channel of maritime silk route is proceeding from the following aspects.

Strengthening the Cooperation between Consigners and Shippers

It is understandable that cold chain shippers are putting forward increasingly high demand on improving freight quality and reducing freight expenses, just like the calculative clients to other trades. However, from the perspective of consigners, running refrigerated container logistics is such a complex and difficult task due to the seasonal variation demands of main shipping routes. And, there are always conflicts among capacity, service and customer requirements which may hinder the development of cold chain logistics [27]. Therefore, making a dialogue between consigners and shippers seem to be an effective solution. The core value of the trustworthy strategic partnership lies in the maintenance of the honest and stable cooperation which is healthy and sustainable developed.

This dialogue is aiming at involving the both sides participate in the process of cold chain management via communication. By providing accurate seasonal variation information in advance, shippers could help the consigners with making early and reasonable shipping arrangements. In addition, for the consigners themselves, the ability of market demand forecasting is worth holding and strengthening, which ensure sustainable earnings for companies and investors. In stressful market environment, both shippers and consigners burden the responsibility to eliminate the low efficient industry traditions. So, for both of the two parties, being good at forecasting the market and keeping a frequent communication, could ensure the timely goods delivery and full loaded hatches.

Enhancing the Cooperation between Consigners and Consignees

Cooperation between consigners and consignees, which is reflecting the higher leveled sense of responsibility between service providers and customers, should be enhanced. More and more distributors in cold chain, such as fruit exporters, likewise come to realize the importance of partnerships. What's more, the differentiating factor of cold chain foods (eg. fruits) lies in the level of service provided, so it is critical to establish a solid strategic partnership among world-wide partners, which may keep the enterprises alive.

Under the circumstances of market deregulation, competition is going to be further fierce, so enterprises (consignee in cold chain logistics) need not only to make some suitable adjustment, but also to forge closer ties with container shipping companies. From the past few years, influence exerted by consignee of cold chain is been greater, which led to the changes in freight contract terms.

To improve the relation between consigner and consignee in cold chain, the cooperation needs to be enhanced by establishing powerful foundation of trust, so that a better business could be achieved.

Develop Specified Refrigerated Container Business

It seems to be a good way to use specified refrigerated ships for perishable foods freighting. However, it’s worth mentioning that when the fruits were picked and batched, they would be loaded onto a specified refrigerated ship, which delivers the merchants to the destination market. It is so long a journey that may cause some losses in profits.

To pose the competitiveness in market price, enterprises should change the modes and strategies of transportation, and find the quickest and most sustainable way to ship the fresh products to their market. Then the refrigerated container comes to be a good choice. If the refrigerated containers were used to ship fresh cargos, they would be in smaller batch and more frequent voyages, making suitable quantities of fresh food ashore every week or even every day, which may contributes to relieve the pressures on stock holding and fresh keeping, ensuring the quality of the cold chain goods to some extent and realize the smooth transition of the supply chain.

What is noteworthy is that the vessels on active duty, especially the small and medium sized ones,
haven’t equipped with enough electrical outlets, causing a big problem for the utilization of refrigerated containers. It is even more important that, the purchase cost of refrigerated containers four times that for dry cargos, but conducting a much higher maintenance cost, and suffering more threats and claims as well as, bearing additional costs for fuel and empty container transshipment. However, the profit earned by refrigerated container freight does not time the profit in dry cargo freight that much as the cost burdened. Therefore, to get an available solution and make a better choice between refrigerated containers and specified refrigerated ships for cold chain freight, analysis should be performed according to specific situations.

**Promoting Quality Monitoring and Management of Cold Chain**

Monitoring and management of cold chain entire process with advanced technology ensures the quality of cold chain, and reduce the losses and better meets the market demands, as well as, improving enterprises earnings. A visual information platform needs to build, which is bearing the core function as the platform collecting and managing system information from all the nodes. So the objectives of cold chain freight— perishable food and things of internet, are well combined to make a faster system query and get real-time quality condition and temperature information of the food which is being freighted by specified refrigerated ships or refrigerated containers, and ensures the safety of foods. To achieve this goal, a combination of technologies such as GPS, RFID and GPRS should be applied comprehensively in the monitoring and management of foods quality in cold chain, and then can an improved and truly maritime cold chain logistics channel be finally established.

**Construction the Cold Chain Channel by Means of "Internet Plus"**

"Internet Plus" means that by regarding internet as the key feature of present information development, and making deeply integration with cold chain logistics to establish a fresh situation of development. "Plus" indicates that to make cross-boundary cooperation, revolution, opening, reshaping and integration, and take innovation as the driving force of development. The original structures of the society, economy, geography and culture have been indeed broken by information reforming, globalization and the internet industry. Therefore, the authorities, rules of procedure and power of discourse have been ever-changing. Frankly speaking, the powerful force equipped by internet originates in the uttermost respect to humanity, the fear to human feelings and the attention paid to the innovation of human beings. So, the segments which have been restricting the production of innovations should be eliminated. And by engaging sporadic innovations in correct patterns, the messy elements of the system will be organic integrated, promoting the realization of general target for the system.

**Conclusion**

Cold chain logistics is an important channel of the maritime Silk Road. According to the perishable characteristics of cold chain goods, it is necessary and important to plan and arrange maritime transportation reasonably, to make effective connection between all parties, and to achieve comprehensive quality control. The negligence of any link may lead to the interruption of the cold chain and the deterioration of perishable products.

To strengthen the construction of cold-chain corridors along the maritime Silk Road, cooperation between cold-chain carriers and cold-chain shippers should be strengthened, and communication between cold-chain carriers and consignees should be strengthened. We should vigorously develop specialized refrigerated container business, comprehensively promote the quality monitoring and management of cold chain, and use the advanced technology such as "Internet +" to build cold chain passages to integrate all the elements of the cold chain goods marine transportation system in an effort to promote the realization of the total body goal of the system and make the maritime Silk Road. The construction of cold chain logistics corridor is more perfect.
References


