

Strategic Planning for the Aviation Logistics Service Supply Chain in China

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Abstract

With the emergence of the international and domestic markets for aviation cargo, the volume of cargo, including postal cargo, for civil aviation has increased, and several purely cargo airlines have emerged. Consequently, competition among aviation logistics enterprises has intensified, and traditional air transportation can no longer meet customer demands for services. Aviation logistics enterprises must strengthen the aviation logistics service supply chain to expand their market. Accordingly, this paper discusses the situations and problems of the aviation logistics service supply chain in China. Moreover, the strategic planning of aviation logistics enterprises in China for the development of this supply chain is examined. To achieve the objectives of this study, the domestic aviation logistics service supply chain in China is first investigated. Three of China's aviation logistics enterprises are selected as research objects for SWOT analysis. From the results of SWOT analysis, four key issues in the service supply chain of China's aviation logistics enterprises are identified: cargo terminals, competitiveness, diversification of service types, and internal information sharing platforms. Finally, TRIZ analysis is performed on the four issues, and 11 strategies are designed for China's aviation logistics service supply chain and then are divided into three phases according to implementation time frame (i.e., short-, medium-, and long-term) to provide references that can be applied to the practice of China's aviation logistics enterprises.

Keywords: Aviation logistics; Service supply Chain; SWOT; TRIZ.

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1. Introduction

Freight volume can effectively reflect the level of business activities in a country or region. Therefore, the logistics industry is an important part of a country's economy. Logistics and transportation methods mainly include water, land, and air transportation. Air transportation is an important part of the aviation logistics process because of its safety and reliability, wide range of spatial radiation, and long-range transportation effectiveness (Zhang *et al.*, 2013). With the emergence of the concept of just-in-time (JIT) logistics, "time" has become an important factor. Therefore, high-priority air transportation is used to execute logistics activities that involve a short supply period, rapid market response, and high-value goods, such as flowers and electronic products. Thus, the proportion of air transportation use has been increasing compared with those of other transportation modes. To achieve fast market response and inventory reduction, air transportation has been used by enterprises to increase product liquidity, decrease capital occupation, and reduce the risk of capital flow disruption. Consequently, aviation logistics transportation has rapidly developed given the reliance of enterprises on air transportation to provide comprehensive services to their customers (Feng, 2015).

The development trend of air cargo has improved in recent years, states that air cargo traffic has been growing strongly in various industries and regions (Zhou, 2018). Global air cargo demands have increased by 11% annually, thereby showing that the global air cargo industry is on the verge of recovery. The report also points out that the growth engine of global air cargo in 2017 was the Asia-Pacific region, with China contributing a third of the world's growth in aviation export (Zhou, 2018). In terms of infrastructure, all regions of China are actively engaged in airport construction. Chongqing, a first-tier city, completed the construction of a third terminal and a third runway in 2017. In the future, Beijing will develop its third large-scale civil airport because of the benefits gained from increased civil aviation traffic (Qiao, 2017). Moreover, various cities have increased their investment in infrastructure, which has led to the development of aviation logistics with airports acting as important nodes. The aviation logistics service industry is expected to flourish in China in the future.

However, given the increasingly intense competition among aviation cargo enterprises, traditional air transportation can no longer satisfy the demands of customers for services. The aviation logistics industry must strengthen its service supply chain to expand its market (Feng, 2015). Accordingly, this study selects three representative domestic aviation logistics enterprises in China: China Southern Air Cargo, China Cargo Airlines, and

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SF Airlines (Qiao, 2017). Through Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis, the common issues of the three aviation logistics enterprises in the aviation logistics service supply chain is summarized. Then, TRIZ analysis is performed to develop improved strategies that can address these common issues. These strategies are divided into three phases (short-, medium-, and long-term) to improve the aviation logistics service supply chain of China's domestic aviation logistics enterprises and to promote the development of China's aviation logistics industry. The remainder of this paper is organized as follows. Section 2 introduces the definitions and characteristics of aviation logistics service supply chain theory and TRIZ theory. In Section 3, SWOT analysis is performed to identify the issues faced by the selected three aviation logistics enterprises in the aviation logistics service supply chain. In Section 4, improved strategies are established to address these issues by performing TRIZ analysis. Then, these strategies are divided into three implementation phases: short-, medium-, and long-term. Finally, conclusions are presented to provide a reference for China's domestic aviation logistics enterprises in building the aviation logistics service supply chain.

2. Literature Review

The definitions and characteristics of aviation logistics service supply chain theory and TRIZ theory are introduced in this section.

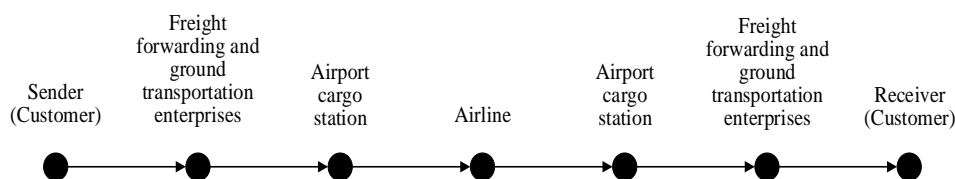
2.1. Aviation Logistics Service Supply Chain

Aviation logistics relies on air transportation combined with other modes of transport, primarily road transportation, to provide customers with a series of door-to-door services (Zhang *et al.*, 2013). The main vehicle used in aviation logistics is aircraft as. In particular, the abdominal cabin of passenger or cargo aircraft is used to transport goods from one station to another. Aviation logistics uses trucks and railway trains to assist in upstream and downstream transportation services. It also adopts modern logistics information technology to connect the sender of the items to the recipient. Aviation logistics is an uninterrupted process (Wei, 2008).

The aviation logistics service supply chain (Figure 1) aims to satisfy the needs of customers by organizing supply sources, linking land and air transportation, and coordinating with upstream suppliers (e.g., shippers, sellers) and downstream consignees (e.g., customers, owners). This network includes consignors, consignees, intermediate freight forwarding enterprises, ground transportation service providers, airport cargo terminal services, air transportation carriers, international logistics transportation, and customs. The members of this network are connected by logistics information systems that enable them to share information. Through this service supply chain, the flow of goods and the exchange of information are realized (Wei, 2008).

The service supply chain is composed of aviation logistics enterprises for the business operations of aviation logistics. These enterprises play an important role in the service chain (Zhang *et al.*, 2013). Compared with the traditional air cargo process, aviation logistics not only needs to complete the transportation of goods but should also actively participate in the entire process of customer logistics operations. Moreover, aviation logistics must design and manage the overall operation of customers' logistics to reduce costs. Therefore, aviation logistics emphasizes the integration of logistics functions and the coordination of cooperative relationships (Qian, 2008).

Figure-1. Aviation logistics service supply chain



2.2. Characteristics of Aviation Logistics Service Supply Chain

From the results of the literature, the three characteristics of the aviation logistics service supply chain are described as follows:

2.2.1. High Customer Involvement

Unlike ordinary supply chains, the starting and finishing points of the aviation logistics service supply chain involve customers. In ordinary production logistics supply chains, customers only play a role at the end of the supply chain. By contrast, the aviation logistics service supply chain begins with one customer and ends with another customer. Therefore, information systems established in aviation logistics are required to connect with customers at the starting and finishing points to complete synchronous information exchange and two-way contact. The response of customers should be received immediately. Thus, customers' participation plays a decisive role in completing the logistics process of the aviation logistics service supply chain. The high degree of customer involvement is the first characteristic of this supply chain (Wei, 2008).

2.2.2. Customer-Driven Demands

The aviation logistics service supply chain is driven by the needs of customers. This supply chain is unable to prioritize inventory. If the needs of upstream customers and supply sources are lacking in aviation logistics, then all

aspects of its supply chain will be missing their service targets. All the activities in the aviation logistics service supply chain will disappear under such condition. Therefore, this supply chain is established in the face of customer demands, and its operation must be implemented based on the needs of customers. Thus, having customer-driven demands is one of the characteristics of this supply chain (Wei, 2008).

2.2.3. Importance of Rapid Response

The characteristics of the aviation logistics service supply chain are similar to those of a responsive supply chain. The most evident characteristic is the uncertainty of market demand, and thus, paying attention to the rapid response of the market is essential. Two factors are considered. The first factor is the diversification of customer groups. Predicting the needs of customers is difficult for aviation logistics enterprises. The required types of services and service levels for each customer may vary considerably. The second factor is the high transportation costs of aviation logistics. Commonly transported goods exhibit the following characteristics: rapid technological development, short life cycle, fast market response, and high sensitivity to market demands. Ordinary production logistics can be prioritized to implement inventory management with a high degree of control for demands. In contrast to the aviation logistics service supply chain, responding quickly is unnecessary in ordinary production logistics. However, controlling market trends is difficult in the aviation logistics industry because prioritizing cargo inventory is challenging (Wei, 2008).

2.3. TRIZ Innovation Rules

The TRIZ method (Abdalla *et al.*, 2005); (Li, 2012); (Zhang, 2012) extracts the 39 engineering parameters listed in Table 1 (Kang, 2004) and the 40 inventive principles provided in Table 2 (Clarke, 1997); (Kang, 2004); (Retseptor, 2005). This method can effectively help designers solve problems in engineering systems according to the contradiction matrix (Clarke, 1997). The problem-solving model of TRIZ aims to identify the corresponding improving and worsening parameters of a problem according to the 39 engineering parameters. Then, the contradiction matrix is used to find relevant inventive principles that can solve the problem based on the contradictory characteristics of improving and worsening parameters. The two axes of the contradiction matrix represent 39 rows of improving engineering parameters and 39 columns of worsening engineering parameters. The intersection of the two axes corresponds to the inventive principles used to solve the contradiction problem. Each intersection provides four or less inventive principles to prevent complications resulting from an excessive number of principles (Wang *et al.*, 2011).

TRIZ can provide scientific principles for solving problems; it is an effective tool that can indicate the direction of exploration (Niu *et al.*, 1999). Therefore, the system improvement method based on TRIZ is favored by various industries. For example, TRIZ was implemented by the Samsung Group in 1997, and billions of dollars in funds and production costs were saved in the subsequent development of TRIZ. In 2001, Boeing achieved technical breakthroughs in the Boeing 737/747/767 models by inviting TRIZ experts. Many European cities have successfully improved traffic problems by using TRIZ (Xu, 2009). At present, TRIZ has been extensively applied to various fields and has been used by people from all walks of life. Tremendous benefits have been gained by using TRIZ. Accordingly, this study adopts TRIZ to establish improved strategies for China's domestic aviation logistics enterprises in the aviation logistics service supply chain, thereby providing a reference for such enterprises.

In recent years, the State Council and the Civil Aviation Administration have emphasized the importance of the development of aviation logistics, such as the notice of the State Council on Issuing the Program for Promoting the Division of Key Development Work in the Civil Aviation Industry in 2013 and the Medium- and Long-Term Plan for the Development of the Logistics Industry (2014–2020) in 2014. Both policies have promoted the development of air cargos. Moreover, the Civil Aviation Administration proposed the policy of “promote air cargo logistics and the transformation of air cargo enterprises from single freight to modern logistics” during the Eleventh and Twelfth Five-Year Plans (Wei and Zhang, 2017). The implementation of relevant policies has promoted the development of the traditional air cargo industry to modern aviation logistics. Therefore, the aviation logistics industry must pay attention to the integration of upstream and downstream elements to change the original composition of the aviation logistics industry and move toward the integration of the service supply chain.

Table-1. Engineering parameters

No.	Parameter	No.	Parameter	No.	Parameter
1.	Weight of moving object	14.	Strength	27.	Reliability
2.	Weight of nonmoving object	15.	Durability of moving object	28.	Accuracy of measurement
3.	Length of moving object	16.	Durability of nonmoving object	29.	Accuracy of manufacturing
4.	Length of nonmoving object	17.	Temperature	30.	Harmful factors acting on object
5.	Area of moving object	18.	Brightness	31.	Harmful side effect
6.	Area of nonmoving object	19.	Energy spent by moving object	32.	Manufacturability
7.	Volume of moving object	20.	Energy spent by nonmoving object	33.	Convenience of use
8.	Volume of nonmoving object	21.	Power	34.	Repairability
9.	Speed	22.	Waste of energy	35.	Adaptability
10.	Force	23.	Waste of substance	36.	Complexity of device
11.	Tension, pressure	24.	Loss of information	37.	Complexity of control
12.	Shape	25.	Waste of time	38.	Level of automation
13.	Stability of object	26.	Amount of substance	39.	Productivity

Table-2. Inventive principles

No.	Inventive principle	No.	Inventive principle	No.	Inventive principle	No.	Inventive principle
1.	Segmentation	11.	Beforehand cushioning	21.	Skipping	31.	Porous material
2.	Taking out	12.	Equipotentiality	22.	Blessing in disguise	32.	Color change
3.	Local quality	13.	Inverse	23.	Feedback	33.	Homogeneity
4.	Asymmetry	14.	Spheroidality	24.	Intermediary	34.	Discarding and recovering
5.	Merge	15.	Dynamics	25.	Self-service	35.	Parameter change
6.	Universality	16.	Partial or excessive action	26.	Copying	36.	Phase transition
7.	Nesting	17.	Another dimension	27.	Cheap short-living objects	37.	Thermal expansion
8.	Antiweight	18.	Mechanical vibration	28.	Mechanics substitution	38.	Boosted interaction
9.	Preliminary antiaction	19.	Periodic action	29.	Pneumatics and hydraulics	39.	Insert atmosphere
10.	Preliminary action	20.	Continuity of useful action	30.	Flexible shell and thin film	40.	Composite structure

3. SWOT Analysis of Aviation Logistics Service Supply Chain

The status of the aviation logistics service supply chain is described in this section. Three representative domestic aviation logistics enterprises in China are selected as research objects. Finally, SWOT analysis is performed on the research objects to understand the problems they encounter in the development of the aviation logistics service supply chain.

3.1. Status of Aviation Logistics Service Supply Chain

Traditional air cargo is only a simple “point-to-point” transportation process that transports goods from one station to another. Such process lacks the docking of transportation services. Problems in air cargo include low added value, small profit space, and weak customer contact (Zhang *et al.*, 2013). With the policy promotion of the “12th Five-Year Plan” by the Civil Aviation Administration, logistics operation has elicited the attention of the government. Air cargo operators have gradually promoted and realized the logistics of air cargo, and domestic air carriers have accelerated their efforts to determine their logistics transformation strategies. For example, China Cargo Aviation under the China Aerospace Group proposed the “Heaven and Earth” strategy to enhance its ground transportation capacity in the Yangtze River Delta region. An efficient aviation logistics service supply chain based on the importance of air transportation services is also established (Wei and Zhang, 2017). Consequently, pure cargo airlines, such as SF Airlines and Longhao Aviation, have sprung up. SF Airlines, which is part of the SF Group, has gained the favor of public consumers because of its superior logistics service level and strong ground transportation and distribution network (Qiao, 2017). Some air cargo terminals are also selected as dominant engines to build regional aviation logistics transformation. For example, a comprehensive airport economic pilot zone is established in Zhengzhou to integrate the aviation logistics service supply chain (Zhang, 2015). The process of the logistics

transformation of air transportation is complete at present. Many enterprises have begun leading the construction and development of the aviation logistics service supply chain.

3.2. Selection of Research Objects

All aspects of aviation logistics are disseminated compared with other transportation modes. Thus, having dominant role players in forming the aviation logistics service supply chain to maintain close connection among various links and to avoid service disruption is necessary. Leading providers of the aviation logistics service supply chain can be any member of aviation logistics. In practice, various leaders exist. The Zhengzhou aviation logistics service chain is based on a single aviation station, which is the leader of the service supply chain. Some air freight forwarding enterprises and airlines also consider themselves leaders (Zhang *et al.*, 2013). In consideration of air transportation, which is the core link of aviation logistics, this study assumes that air transportation companies should lead the aviation logistics service supply chain.

Three domestic aviation logistics enterprises are selected as research objects in this study: China Southern Airlines Cargo, China Cargo Airlines, and SF Airlines. China Southern Airlines Cargo is a freight business department under China Southern Airlines. It joined the SkyTeam Cargo in 2010 and became China's first airline to join the international air cargo alliance. China Cargo Airlines is jointly owned by China Eastern Airlines and China Ocean Transportation Company and is the earliest all-cargo air carrier in the country. SF Airlines is a subsidiary of the SF Express Group and is the first domestic airline founded by a private courier company. The three aviation logistics enterprises are the leaders in the aviation logistics industry and can represent the industry's development.

3.3. SWOT Analysis

In this study, China Southern Air Cargo, China Cargo Airlines, and SF Airlines are selected as research objects, and data are summarized from relevant references and information from the three enterprises' official websites, namely, www.csair.com (China Southern Air Cargo), tang.cs-air.com (China Cargo Airlines), and www.sf-airlines.com (SF Airlines) to implement the SWOT analysis. Tables 3, 4, and 5 present the results of the SWOT analysis of the three research objects.

On the basis of the SWOT analysis results of China Southern Air Cargo, China Cargo Airlines, and SF Airline, the three enterprises face common issues in developing the aviation logistics service supply chain. These issues are extracted and summarized in Table 6 as follows: "improvement of control over cargo terminals," "competitiveness," "service products, business types," and "internal information sharing platforms." Air logistics is a logistics model based on customer demands. If problems exist in the logistics operation process, then the delivery of cargo may be negatively affected and customer perception may deteriorate. In the long term, customers may be lost and the company's profitability may decline. Therefore, improved strategies for the four issues listed in Table 6 must be established to provide domestic aviation logistics service enterprises with a reference for building the aviation logistics service supply chain and promoting the development of the aviation logistics industry.

4. Construction of TRIZ Strategies for Aviation Logistics Service Supply Chain

From the SWOT analysis results of China Southern Air Cargo, China Cargo Airlines, and SF Airlines, the following key issues are shared by the research objects in the development of the aviation logistics service supply chain: "improvement of control over cargo terminals," "competitiveness," "service products, business types," and "internal information sharing platforms." To remain as China's domestic aviation logistics service providers in the future development process, aviation enterprises must understand the key issues that they face. They must also rely on the development of favorable strategies to solve these key issues and to provide services that can meet customers' needs. Therefore, TRIZ theory is used to construct strategies for China's domestic aviation logistics service providers in the development of the aviation logistics service supply chain.

4.1. Analysis Steps of TRIZ

Savransky (2002) proposed the implementation steps for the application of contradictory matrices and 40 innovative principles in TRIZ theory as follows: (1) identifying issues, (2) determining improving and worsening parameters, (3) searching for the intentions of innovative principles, and (4) constructing strategies based on the innovative principles. Therefore, the following issues are the four key issues identified from the SWOT analysis results of Southern China Air Cargo, China Cargo Airlines, and SF Airlines. Then, the corresponding improving and worsening parameters are determined according to the identification of issues. Through the contradiction matrix, the principles of innovation can be found, and strategies for China's domestic aviation logistics service providers in the development of the aviation logistics service supply chain can be established based on the intentions of the innovative principles. Finally, the strategies for the four key issues are divided into three phases (short-, medium-, and long-term) for developing the aviation logistics service supply chain (Figure 2).

TRIZ theory uses different fields, and thus, the intentions of 39 engineering parameters and 40 innovation principles will also vary. This study uses Wang *et al.* (2011) as the reference for interpreting the intentions of engineering parameters and an innovation principle in aviation logistics.

Table-3. SWOT analysis of China Southern Airlines Cargo

Category	Analysis results	Reference sources
Strengths	<ol style="list-style-type: none"> 1. Advantage of geographic location: Uses Guangzhou as a hub and includes the Pearl River Delta freight resources. 2. Information system of TANG CSN Cargo Online, facilitates docking with customers. 	(Wei and Zhang, 2017), (China Southern, 2013)
Weaknesses	<ol style="list-style-type: none"> 1. A FedEx transshipment center has been built in Baiyun Airport, but China Southern Airlines Cargo has invested less in cargo terminal and has not strived to take control of the Baiyun Airport cargo terminal. 2. Single-business model and service product type, low added value. 3. China Southern Airlines Cargo cannot operate independently from China Southern Airlines. 	(Wei, 2008), (China Southern, 2013)
Opportunities	<ol style="list-style-type: none"> 1. Guangzhou Baiyun Airport strengthens construction and plays a pivotal role. 2. Connected to SkyTeam Cargo to drive the development of business. 3. Policies of State Council and Civil Aviation Authority support the development of aviation logistics. 	(Wei and Zhang, 2017)
Threats	<ol style="list-style-type: none"> 1. Longhao Aviation is the new rising competitor stationed in Baiyun Airport Base, and SF Airlines is based in Shenzhen. The aviation logistics market is intensely competitive in Guangdong. 2. The Guangzhou Railway Group strengthens the promotion of high-speed railway express business to capture the market. 3. In the aviation logistics industry, the informatization degree is low and information sharing platforms are lacking. 	(Zhong and Li, 2011), (Xie and Wu, 2012)

Table-4. SWOT analysis of China Cargo Aviation

Category	Analysis results	Reference sources
Strengths	<ol style="list-style-type: none"> 1. Advantage of geographic location: Uses Shanghai as a hub, covers two international airports and seven air cargo terminals, and includes the cargo resources of the Yangtze River Delta. 2. Covers a global aviation route network where cargo can be transported using aircraft cabin. 3. Good corporate development strategy. The development strategy of "Heaven and Earth" takes advantage of air transportation and strengthens the construction of ground transportation networks. 	(Qiao, 2017), (Zhang, 2015)
Weaknesses	<ol style="list-style-type: none"> 1. Information technology level is backward (lack of advanced logistics information systems). 2. The cargo terminal is not exclusively used, and the controlling force of the cargo terminal is weak. 3. Single product type, short chain, low added value 4. Connection of service chain is poor. Facing customers is difficult. Market adaptability is low. 	(Zhang, 2015), (Wei, 2008)
Opportunities	<ol style="list-style-type: none"> 1. The development of the air transportation market has improved. 2. Infrastructure construction is accelerated and plays a pivotal role. 3. National policy supports the development of aviation logistics. 	(Wei and Zhang, 2017)
Threats	<ol style="list-style-type: none"> 1. With the entrance of SF Airlines, competition in the aviation logistics industry has become increasingly intense. 2. Express Rail Express is being actively developed to capture the market. 3. In the aviation logistics industry, the informatization degree is low and information sharing platforms are lacking. 4. The members of the service chain operate independently from one another. 	(Zhong and Li, 2011), (Xie and Wu, 2012)

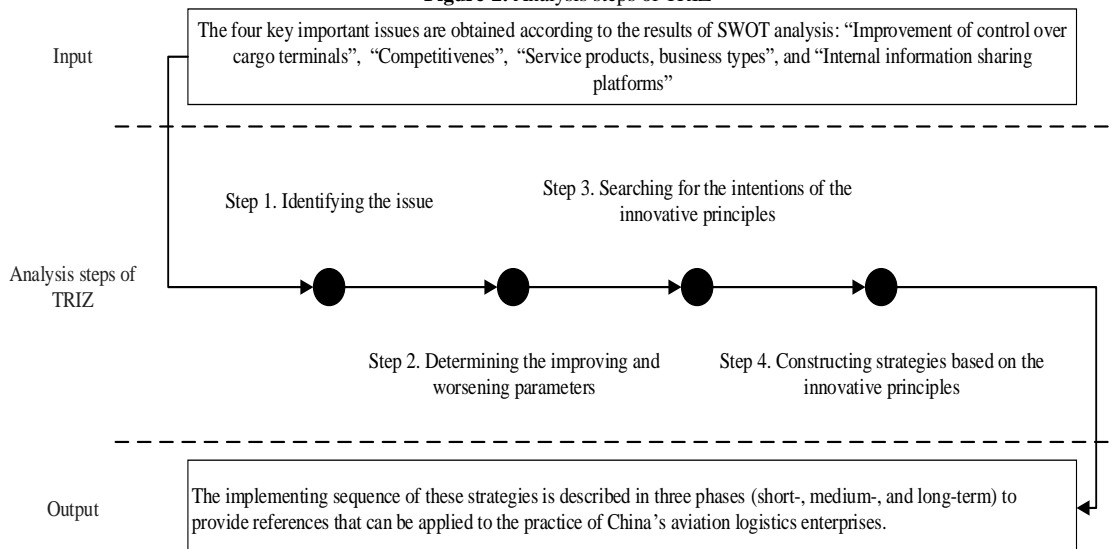
Table-5. SWOT analysis of SF Airlines

Category	Analysis results	Reference sources
Strengths	<ol style="list-style-type: none"> 1. Advantage of geographic location: Uses Bao'an Airport as a hub. 2. Up to 40 full freighters, strong fleet. 3. Powerful ground transportation network support. 	(SF Airlines, 2018)
Weaknesses	<ol style="list-style-type: none"> 1. Domestic shipping routes are strong, but international route development is weak. 2. Single product type. 3. Lack of investment in cargo terminals makes controlling cargo terminals difficult. 	(Wei, 2008)
Opportunities	<ol style="list-style-type: none"> 1. Increases the effect requirements for China's domestic e-commerce logistics. 2. Shenzhen Special Economic Zone provides tax incentives. 3. State Council policy supports the development of the logistics industry. 	(Wei and Zhang, 2017)
Threats	<ol style="list-style-type: none"> 1. Longhao Aviation has entered the Guangdong market, and the regional market is intensely competitive. 2. Guangzhou Railway Group strengthens the promotion of high-speed railway express business to capture the market. 3. In the aviation logistics industry, the informatization degree is low and information sharing platforms are lacking. 	(Zhong and Li, 2011), (Xie and Wu, 2012)

Table-6. Key issues in the aviation logistics service supply chain

No.	Key issue	Definition
1	Improvement of control over cargo terminals	Aviation companies have a small investment in air cargo terminals. Thus, they cannot determine the status of goods in cargo terminals and cannot control their time of stay in terminals. The overall length of transportation is long, and customers cannot obtain the status of goods, which negatively affects the aviation logistics service supply chain.
2	Competitiveness	All-cargo aviation continues to enter the aviation logistics market. The development of high-speed rail express of railway corporations has also affected the aviation logistics market. Aviation companies must improve their competitiveness to remain in the intensely competitive market.
3	Service products, business types	The small added value of current service products has resulted in a small profit margin for aviation companies. The main reasons are the short service chain, few types of service products, and no product with customer-specific features. Given the price competition between similar service products, the operation of companies may be negatively affected in the long run.
4	Internal information sharing platforms	Domestic aviation enterprises invest relatively less in logistics information systems than other enterprises. Although they have logistics information systems, incompatibility exists among systems and internal information sharing platforms are lacking. The opaque environment slows down the development of individual companies and the industry.

Figure-2. Analysis steps of TRIZ



4.2. Establishment of Aviation Logistics Service Supply Chain Strategies

Four key issues, namely, “improvement of control over cargo terminals,” “competitiveness,” “service products, business types,” and “internal information sharing platforms,” are obtained from the results of the SWOT analysis. Through the implementation steps of TRIZ theory, the strategies for China’s domestic aviation logistics service providers can be established to develop the aviation logistics service supply chain.

4.2.1. Improvement of Control Over Cargo Terminals

Step 1. Identifying the issue

The origin and termination points of air transportation are the cargo terminals of airports according to the composition and operation of the aviation logistics service supply chain. The two forms of airport cargo terminals have played two completely different roles in the aviation logistics chain. The first is the freight terminal for receiving goods, whereas the second is the freight terminal for delivery. Both locations are key points for connecting air and road transportation. However, airlines have low investment in airport cargo terminals at present, and their controlling force for cargo terminal is weak.

The main operation of airport cargo terminals includes implementing safety inspections, temporary storage of goods, and loading and handling operations. The operations within a cargo terminal are relatively controllable with respect to aircraft flight (Feng, 2015). However, multiple operations are involved in a single cargo terminal, which increases uncontrollability. If airlines allow air cargo terminals to operate inefficiently, then the aviation logistics service supply chain will be negatively affected.

If the loading of goods cannot be monitored, then flight safety will be affected. Customers’ demand for cargo information cannot be met if the status of goods cannot be traced. The long length of stay of goods in cargo stations affects the timeliness of cargo transportation. The low-quality operating status of cargo terminals seriously affects the overall operation of the aviation logistics service supply chain. Therefore, airlines should increase their investment in cargo terminals to strengthen control of aviation cargo terminals.

Step 2. Determining the improving and worsening parameters

On the basis of the issue “improvement of control over cargo terminals,” airlines are currently not in control of aviation cargo terminals and cannot control the operations of cargos at cargo terminals. Consequently, an efficient operation of cargo terminals cannot be guaranteed. Independently operating aviation cargo terminals make the use of various resources of aviation cargo terminals difficult for airlines. Therefore, airlines must strengthen their overall control of aviation cargo terminals to improve the convenience of using such terminals. Improving this parameter is represented as “33. Convenience of use” in Table 1.

Aviation logistics enterprises must increase their input to cargo terminals to obtain a higher level of cargo control. Table 1 shows that the inversion of parameter “21. power” can be interpreted as the change in expenditure costs (profits). Thus, the worsening parameter is “21. power.”

Step 3. Searching for the intentions of the innovative principles

The intersection of “33. convenience of use” on the improving axis and “21. power” on the worsening axis is selected in the contradiction matrix. Then, four innovative principles are obtained: “Principle 2: taking out,” “Principle 10: preliminary action,” “Principle 34: discarding and recovering,” and “Principle 35: parameter change.”

On the basis of the intentions of the innovative principles, “Principle 2: taking out,” “Principle 10: preliminary action,” and “Principle 35: parameter change” are selected.

Step 4. Constructing strategies based on the innovative principles

The intention of “Principle 10: preliminary action” is to ensure changes in the object or system requirements before implementation. Thus, aviation logistics enterprises should first analyze market demand and then select the appropriate market to increase investment and reduce the waste of resources due to decentralized input.

Aviation logistics has many routes, which means that many aviation sites exist. However, huge expenditures will only cause waste of corporate resources if investment in cargo terminals is increased for all aviation sites in the vicinity. Therefore, aviation logistics operators must evaluate the operation of aviation cargo terminals and forecast market demands before investing. For China Cargo Airlines under China Eastern Airlines, Macau International Airport is not the focus of its logistics business. Therefore, the cargo terminal business of Macau International Airport can be outsourced to suitable freighter forwarders for operation (Macau International Airport, 2012). The cargo volume of Shanghai Pudong Airport ranks among the top three in China. Therefore, many airlines in Pudong Airport have set up cargo operations (Pactl, 2014). China Cargo Airlines must also have control of this area. However, not all aviation cargo terminals are suitable for increasing investment. Airlines should complete the evaluation before investing and then select important aviation sites for investment.

The intention of “Principle 2: taking out” is defined as “the removal of an obstruction from an object or system.” At present, airlines cannot fully use aviation cargo terminals under normal circumstances. The condition of common cargo terminals leads to confusion and wrong loading when handling cargos. If circumstances permit, then the independent use or the use of self-built cargo stations can effectively control operation in a cargo terminal. Therefore, aviation logistics enterprises can acquire the right to use cargo terminals by renting or financing mergers and acquisitions of existing cargo terminals.

Taoyuan International Airport (2015) reported that its cargo zone has four operating cargo terminals. Evergreen Air Cargo Corporation (EGAC) is one of these terminals. The Evergreen Group can clearly control the status of cargos in the warehouse through self-operated aviation cargo terminals. Customers can also check the status of cargos from the official website of EGAC. The Evergreen Group connects with customers through its official website to satisfy customer service demands for cargo information and to improve the functions of the aviation

service supply chain. Domestic airline logistics enterprises can imitate the Evergreen Group by renting facilities in aviation cargo parks or financing mergers and acquisitions with existing cargo terminals to extend its effectiveness to its own aviation logistics company.

The intention of “Principle 35: parameter change” is defined as “to change the physical state of an object or system.” When an aviation cargo terminal is used by aviation logistics companies, the original manual operation mode can be changed to an automatic operation mode.

Manual operations inevitably result in mistakes. Occasionally, cargos are misloaded to other aircraft or transported to the wrong aviation terminal. At present, many high-level logistics machinery and equipment have been developed with low error rates and high operating efficiency. Therefore, aviation logistics enterprises should exert extreme caution when constructing automation equipment to increase input in cargo terminals. For example, cargo tracking can be achieved through radio-frequency identification technology, and manual information entry can be eliminated. The replacement of manual sorting with 3D warehouses or automated sorting systems can improve the efficiency of storage and package of cargos and reduce the wrong delivery of cargos. Thus, replacing manual operations with automated operations can reduce wrong deliveries and waste of resources. The amount of completed work per unit of time can be increased, the loss of costs can be reduced, and total revenue can be increased.

4.2.2. Competitiveness

Step 1. Identifying the issue

Air China, the HNA Group, and other state-owned airline enterprises respond to the policies promulgated by the State Council and the Civil Aviation Administration to promote the development of logistics and air transportation and place considerable importance on their logistics operations. Therefore, competition in the original aviation logistics market has become intense (Wei and Zhang, 2017). In recent years, economic data, such as air cargo and postal traffic, have been recorded, thereby attracting numerous investors to join the aviation logistics industry (Qian, 2008). With Guangzhou as its base, Longhao Aviation and other private purely freight aviation enterprises have also emerged. Undoubtedly, the order of the existing market in the aviation logistics industry has been disturbed by these rising players. China Railway has also targeted the growing logistics market and has developed a high-speed railway logistics business. During the marketing activities of the Double 11 Shopping Festival, the operations of high-speed railways were strengthened to promote their service in the expanding logistics market. The logistics industry in China is becoming increasingly becoming competitive. Thus, the aviation logistics industry must enhance its own competitiveness to withstand peer pressure and remain in the market without being eliminated.

However, enterprises are mainly interested in profits. Among products with the same quality, those with low prices frequently dominate the market. Enterprises must respond quickly to avoid failure to response to a changing market. To win the market with more competitive products, enterprises frequently adopt actions, such as maintaining prices to reduce quality or maintaining quality to reduce prices. However, these actions will have adverse effects on the decline in the profitability or the decline in the quality of products and services.

Step 2. Determining the improving and worsening parameters

From the definition of the “competitiveness” issue, market competition is becoming intense, and the aviation logistics industry must implement actions to resist pressure from external competitors and enhance its own competitiveness. Therefore, the improving parameter is “14. strength.” However, most response actions taken by enterprises can negatively affect the decline in the profitability of and quality of products and services. Therefore, the worsening parameter is “31. harmful side effect.”

Step 3. Searching for the intentions of the innovative principles

In accordance with the combination of the improving parameter “14. strength” and the worsening parameter “31. harmful side effect,” the innovation principles provided in the contradiction matrix are “Principle 15: dynamics,” “Principle 35: parameter change,” “Principle 22: blessing in disguise,” and “Principle 2: taking out.”

On the basis of the intentions of the innovative principles, two innovative principles are selected: “Principle 35: parameter change” and “Principle 22: blessing in disguise.”

Step 4. Constructing strategies based on the innovative principles

The intention of “Principle 35: parameter change” is to change the consistency and elasticity of the original states. This principle reminds enterprises to avoid the negative impact of price competition when developing strategies by focusing on flexibility and the development of diverse products and services.

In terms of service objects, the source of mass cargos for aviation logistics is currently general cargo and mail. These types of cargo can easily use other modes of transportation. Therefore, the bargaining power of aviation logistics enterprises can decline. In China, similar product types are provided by most aviation logistics enterprises, whereas personalized products are relatively few. In accordance with “Principle 35: parameter change,” diversified and customized service products can be provided to help the aviation logistics enterprises stand out in the intensely competitive market. Many successful cases of service design for domestic aviation enterprises are provided by foreign aviation enterprises. For example, the following service products are provided by SkyTeam Cargo to its customers (China Southern, 2013).

- (1) Express: This type of cargo has the highest priority loading right.
- (2) JIT goods: Logistics solutions are tailored for customers.
- (3) Special cargos: Operational procedures are specifically tailored, and this type of cargo has booking priority.
- (4) General cargos: Aircraft cabins are flexibly used to provide the most economical service.

Although the development trend of high-speed rail expressways is strong, the high-speed rail express is limited because of the passenger transportation business of high-speed railways. The delivery of cargos can only be added to

ordinary electric multiple units (EMUs) after passenger operations are completed. Therefore, the fastest time for cargo delivery of high-speed railways can only be completed through overnight delivery. The delivery of special cargos, such as extra-large and cold chain temperature-controlled cargos, cannot be completed. By contrast, if customers have special shipping requirements, then aviation logistics companies can use the aircraft cabin of an existing passenger route to realize rapid transportation because custom-built special temperature-controlled container technology is mature. Therefore, aviation logistics enterprises can maintain their competitiveness amid the impact of high-speed railways through diverse and customized service product designs.

Peer competition is equally intense. However, competing at a comparable price by reducing prices at comparable service levels can negatively affect both parties. The definition of “Principle 22: turning harmful to beneficial” adds other harmful activities to solve major harmful activities. Thus, aviation logistics enterprises can cooperate with one or more counterparts to deal with competition from other competitors. Thus, cargo airline alliances can be established with suitable aviation logistics enterprises to offset the negative impact of competition.

Favorable prices, abundant aircraft fleets, and a broad route network are important components for increasing the competitiveness of aviation enterprises. If these components are completely reformed, then the investment of aviation enterprises in infrastructure and operational efficiency must be increased. The practice of cooperating with another aviation company to counter competitors already occurs in air passenger transportation. China Eastern Airlines and China Southern Airlines are SkyTeam alliances. These airlines share routes through code sharing to expand their airline networks and counter the impacts of Air China and HNA. Through cooperation, China Southern Airlines and China Eastern Airlines have opportunities to share resources and route networks in terms of freight to resist competition from peers and high-speed railways. Other aviation logistics enterprises can also organize strategic partnerships. Through such alliance, the strategy of reducing prices becomes unnecessary, and aviation enterprises can occupy an extensive market and coverage. Consequently, the negative impact of increasing competition can be avoided.

4.2.3. Service Products, Business Types

Step 1. Identifying the issue

At present, the types of services that aviation logistics enterprises can provide are relatively simple. Traditional air transport only requires the completion of point-to-point operations from one airport to another airport. Such air transport rarely provides customized services in response to customer demands. High revenues cannot be produced because of a decline in the bargaining power of aviation logistics enterprises. Moreover, the short service chain and low added value result in low profits. Therefore, aviation logistics enterprises should increase the types of provided logistics products. They must also offer customized solutions to key customers to increase profits.

Step 2. Determining the improving and worsening parameters

The types of services currently provided by aviation logistics enterprises are limited, and thus, must be augmented. Accordingly, the improving parameter is “26. amount of substance.” However, an increase in service types may require additional corresponding logistics machinery and equipment, which in turn, will result in cost loss. Moreover, different service types have varying requirements for employee operation, which can easily result in confusion and low efficiency. Therefore, the worsening parameter is “31. harmful side effect.”

Step 3. Searching for the intentions of the innovative principles

On the basis of the mapping of the improving parameter “26. amount of substance” and the worsening parameter “31. harmful side effect” onto the contradiction matrix, the following innovative principles can be applied: “Principle 3: local quality,” “Principle 35: parameter change,” “Principle 40: composite structure,” and “Principle 39: inert atmosphere.”

In accordance with the intentions of the innovative principles, “Principle 3: local quality,” “Principle 40: composite structure,” and “Principle 39: inert atmosphere” are selected.

Step 4. Constructing strategies based on the innovative principles

The intention of “Principle 3: local quality” is to make the functions of each part or system suitable for operation. A globally uniform standard can be formulated by the aviation logistics industry to provide strategies for localized or customized services according to the needs of the region or specific customers.

Considering McDonald’s and KFC as precedents, standard operating guidelines are developed for their stores worldwide. When customers travel around the world, they can enjoy a relatively stable meal quality. Meanwhile, diversification and localization are also actively implemented in different regions. For example, the product “Filet-o-Fish” was especially developed by McDonald’s for Japanese consumers, whereas the rice meals of KFC are developed for consumers in China (Ma, 2012). Similarly, a standard operation process can be built worldwide by aviation logistics enterprises to promise customers with certain product characteristics, such as timeliness. Under a relatively stable service level, designing products based on local conditions is possible. For example, cold chain logistics can be provided for transnational distribution in Japan’s fishery market, whereas priority distribution services can be designed for semiconductor manufacturing enterprises in Taiwan. Under the premise of ensuring uniform standards, localized and customized services can be provided to diversify the models of companies. Therefore, competition from other aviation logistics enterprises and high-speed express trains is counteracted and the decline in service levels caused by diverse services is avoided.

The intention of “Principle 40: composite structure” is to replace a consistent structure with a composite structure. In addition to providing different types of horizontal services, aviation logistics enterprises can develop vertical services at different levels based on various types of services. That is, aviation logistics enterprises should not only expand in one dimension but should also develop under a 2D plane.

Horizontally, the aviation logistics industry can develop different types of products, such as general cargo, fresh cold chain, and special cargo. Providing various levels of service types to different levels of consumer groups for the same type of product is also possible. For example, high-end seafood may be more time-sensitive than flowers in the same fresh cold chain logistics business, and thus, higher shipping prices can be set for high-end seafood. Under such condition, the aviation logistics industry can launch high-, medium, and low-end cold chain logistics products. Through the positioning and division of consumer groups, horizontal and vertical simultaneous expansion is conducive to increasing profits from original single-type products for aviation logistics enterprises.

However, market demand is changeable, and an increase in business type indicates that market risk can also grow. In accordance with “Principle 39: inert atmosphere,” ensuring that the business development of enterprises is maintained in a relatively stable market demand environment is necessary when aviation logistics enterprises develop diverse businesses.

Aviation logistics providers can use big data analysis to predict and control changes in market demands. However, the expansion of service provision should not be excessive in the continuously changing demand environment to avoid excessive resource consumption and depreciation caused by the unnecessary purchase of equipment. Inefficient operation caused by the hockey stick effect (Moore, 1991) can also be mitigated.

4.2.4. Internal Information Sharing Platforms

Step 1. Identifying the issue

Nearly all airline enterprises have built their own information systems. However, communicating and sharing horizontal information among members of the aviation logistics industry is difficult due to differences in information system development, use of information processing technologies, and incompatibility of equipment. Thus, logistics information sharing platforms across the entire industry are lacking, which affects the efficiency of the aviation logistics industry in China. Simultaneously, foreign airlines are actively building aviation logistics networks in China, which reduces the share of Chinese aviation logistics companies in the international market (Wei and Zhang, 2017). Therefore, building internal information sharing platforms in the aviation logistics industry is imperative. Aviation logistics companies must also face the risk of leakage of business confidentiality while sharing information.

Step 2. Determining the improving and worsening parameters

From the definition of the issue of “internal information sharing platforms,” information exchange in the aviation logistics industry can be accomplished through information platforms to change the state of information loss. Therefore, the improving parameter is “24. loss of information.” In the process of docking information systems in the aviation logistics industry, the daily operations of companies become transparent, operational data may expose company operations, and the appearance of technical problems can lead to the disclosure of corporate secrets. Thus, the worsening parameter is “30. harmful factors acting on object.”

Step 3. Searching for the intentions of the innovative principles

When the intersection of the improving parameter “24. loss of information” and the worsening parameter “30. harmful factors acting on object” in the contradiction matrix is considered, three innovative principles are provided: “Principle 22: blessing in disguise,” “Principle 10: preliminary action,” and “Principle 1: segmentation.” The three innovative principles are used to construct a strategy.

Step 4. Constructing strategies based on the innovative principles

The intention of “Principle 10: preliminary action” is to pre-introduce useful functions into objects or systems. Given this intention, system vulnerabilities should be checked first, system stability should be detected, and the risk of system information leakage should be evaluated by a professional information technology team before setting up information platforms or linking information systems among aviation logistics enterprises. Therefore, these enterprises must evaluate risks in advance before building information platforms to avoid the massive outflow of confidential information while accessing information platforms.

The intention of “Principle 1: segmentation” is to divide objects or systems into separate parts. First, the overall corporate information system is divided into two parts: the internal and external systems. The corporate internal network can be built and improved by the technical department. Then, the confidential content can be preserved in the internal system, and the stability of the internal information system can be strengthened. Second, available information can be saved in external systems for sharing through electronic data interchange technology. Therefore, aviation logistics enterprises should separate internal and external system networks.

The intention of “Principle 22: blessing in disguise” is to use harmful factors to achieving positive effects. If loopholes are found in an information system, then the reason behind these loopholes should be analyzed immediately. Accordingly, technology and personnel actions should be proposed to eliminate information loopholes. Therefore, specialized information technology departments and regulatory agencies must be developed in aviation logistics enterprises. Regulatory agencies should conduct regular inspections to discover system vulnerabilities and notify technical departments, and then, loopholes can be immediately repaired by these departments. Therefore, aviation logistics enterprises must repair information systems immediately after discovering vulnerabilities.

4.3. Strategy Summary

4.3.1. Summary of Strategies

The four key issues faced by the three research objects are analyzed to find the corresponding improving and worsening parameters. Then, the corresponding innovative principles are found in the contradiction matrix. Consequently, four key issues are mapped onto the contradiction matrix, and the innovative principles are summarized in Table 7.

On the basis of the identified innovative principles, 11 strategies have been established by applying the TRIZ approach to help aviation logistics enterprises solve problems when developing the aviation logistics service supply chain. These strategies are summarized in Table 8.

4.3.2. Implementing Sequence of Strategies

To enable the functions of the 11 strategies listed in Table 8 to work effectively, the implementing sequence of these strategies is described in three phases: short-, medium-, and long-term (Table 9).

Table-7. Inventive principles extracted from the contradictions matrix

Worsening parameter Improving parameter	21. Power	30. Harmful factors acting on object	31. Harmful side effects	Key important issues
14. Strength	.....	.....	15, 35, 22, 2	Competitiveness
24. Loss of information	.....	22, 10, 1	.....	Internal information sharing platforms
26. Amount of substance	.....	.....	3, 35, 40, 39	Service products, business types
33. Convenience of use	35, 34, 2, 10	.....	.....	Improvement of control over cargo terminals

Table-8. Strategies constructed by applying TRIZ approach

Key important issues	Improving parameter	Worsening parameter	Innovative principles	Strategy design
Improvement of control over cargo terminals	33. Convenience of use	21. Power	10. Preliminary Action	S1. Analyze market demand to select the appropriate market for increasing input to cargo terminals.
			2. Taking Out	S2. Obtain the use rights of cargo terminals by renting or financing mergers and acquisitions of existing cargo terminals.
			35. Parameter Change	S3. Change the original manual operation mode to an automatic operation mode.
Competitiveness	14. Strength	31. Harmful side effects	35. Parameter Change	S4. Focus on flexibility and the development of diverse service products.
			22. Blessing in Disguise	S5. Cooperate with suitable aviation logistics enterprises to form cargo airline alliances.
Service products, business types	26. Amount of substance	31. Harmful side effects	3. Local Quality	S6. Formulate unified standards and provide localized or customized services according to the needs of regions or specific customers.
			40. Composite Structure	S7. Simultaneous horizontal and vertical developments of business diversification.
			39. Insert Atmosphere	S8. Control and predict changes in market demand.
Internal information sharing platforms	24. Loss of information	30. Harmful factors acting on object	10. Preliminary Action	S9. Pre-evaluating the risk of system information leakage.
			1. Segmentation	S10. Divide the enterprise information system into internal and external system networks.
			22. Blessing in Disguise	S11. Immediately repair information system vulnerabilities after discovering them.

First, aviation logistics enterprises face competition. They are bound to experience the problem of aviation logistics service scope. This problem is the first test that affects the ability of aviation logistics enterprises to survive all types of competition in the market. In the short-term strategy development, enterprises can focus on “an analysis of market demand to select the appropriate market for increasing input to cargo terminals” (S1), and then proceed to “focus on the flexibility and development of diverse service products” (S4) and “formulate unified standards and provide localized or customized services according to the needs of regions or specific customers” (S6) according to the selected market. Moreover, “pre-evaluating the risk of system information leakage” is necessary (S9) to establish future information sharing platforms.

Second, domestic aviation logistics enterprises should fully expand the share of China’s aviation logistics market during the medium-term strategic development period. Consequently, business volume increases. Aviation logistics enterprises can “obtain the use rights of cargo terminals by renting or financing mergers and acquisitions of existing cargo terminals” (S2) and “cooperate with suitable aviation logistics enterprises to form cargo airline alliances” (S5) to provide stable aviation logistics services. Moreover, aviation logistics enterprises must prudently evaluate the cost issue due to the increase in business volume. Thus, they can adopt “horizontal and vertical developments of business diversification” (S7) to increase profits from services. Aviation logistics enterprises should also “divide the enterprise information system into internal and external system networks” (S10) to consolidate the stability of information sharing platforms due to the increase in business volume.

Finally, in addition to maintaining market competitiveness, the core operating mechanism of aviation logistics enterprises will determine the direction and speed of their development during the period of long-term strategic development. Aviation logistics enterprises should continue to “try to control and anticipate changes in market demands” (S8) to understand the potential needs of customers. In terms of establishing the core operating mechanism, aviation logistics enterprises can “change the original manual operation mode to an automatic operation mode” (S3) to increase operation efficiency. Such change establishes specialized information technology departments and regulatory agencies to conduct regular inspections on information sharing platforms. Consequently, “enterprises must immediately repair information system vulnerabilities after discovering them” (S11).

4.3.3. Expected Effect of Improvement

Operation units are divided before implementing the established strategies. Each unit is independent although the aviation logistics service supply chain of enterprises is a chain structure. Enterprises also face increased competitive pressure (Figure 3).

After implementing the strategies, core enterprises can obtain use rights for cargo terminals by renting or financing the mergers and acquisitions of existing cargo terminals. Through cooperation with other suitable aviation logistics enterprises and information exchange via internal information sharing platforms, aviation logistics enterprises can obtain additional market information. Then, a positive effect can be attained on long-term forecasting and control of changes in market demands and bi-directional diverse services (Figure 4).

Table-9. Implementation sequence of strategies

Short-term	Medium-term	Long-term
S2. Obtain the use rights of cargo terminals by renting or financing mergers and acquisitions of existing cargo terminals. S5. Cooperate with suitable aviation logistics enterprises to form cargo airline alliances. S9. Pre-evaluating the risk of system information leakage.	S1. Analyze market demand to select the appropriate market for increasing input to cargo terminals. S4. Focus on flexibility and the development of diverse service products. S6. Formulate unified standards and provide localized or customized services according to the needs of regions or specific customers. S7. Simultaneous horizontal and vertical developments of business diversification. S10. Divide the enterprise information system into internal and external system networks.	S3. Change the original manual operation mode to an automatic operation mode. S8. Control and predict changes in market demand. S11. Immediately repair information system vulnerabilities after discovering them.

Figure-3. Aviation logistics service supply chain before implementing the aforementioned strategies

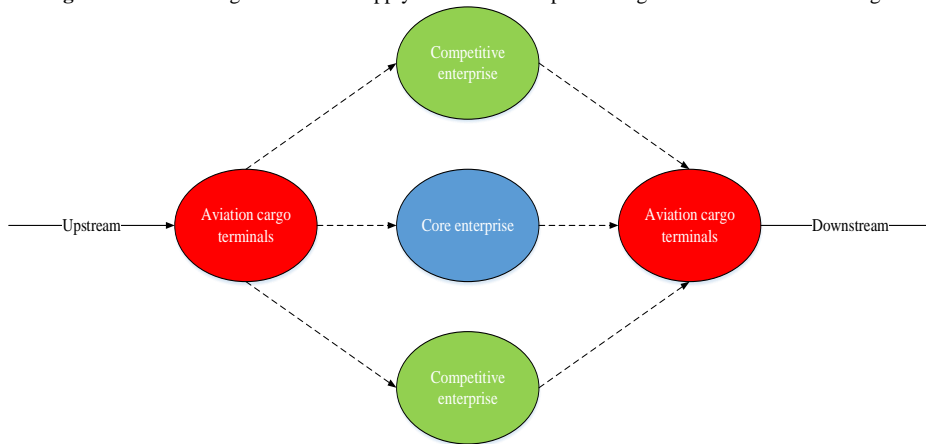
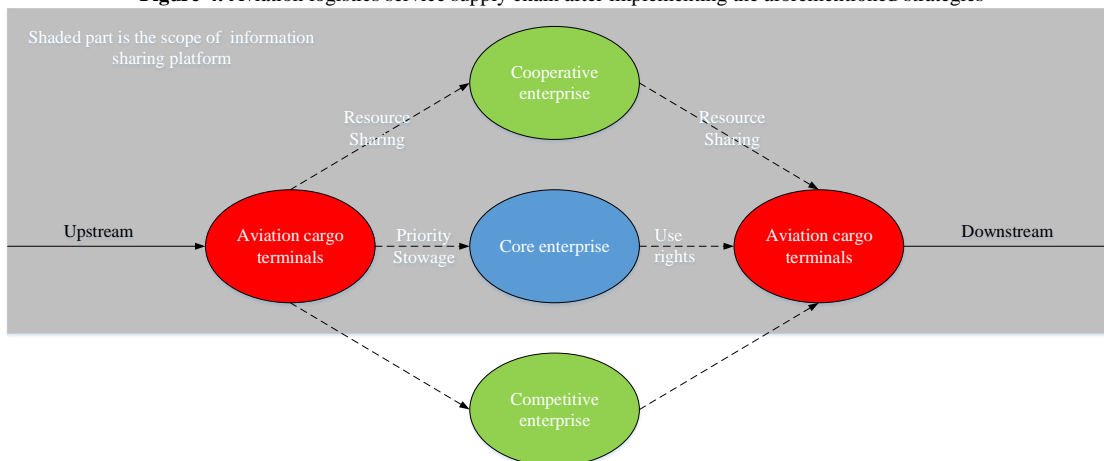


Figure-4. Aviation logistics service supply chain after implementing the aforementioned strategies



5. Conclusion

As the global and domestic air cargo markets gradually recover, the volume of aviation cargo traffic has increased and aviation cargo enterprises have grown. With the increasingly intense competition among aviation cargo enterprises, traditional air transportation can no longer satisfy customers' demand for services. Aviation logistics enterprises must strengthen their service supply chain to expand their market. To date, the concept of aviation logistics service supply chain has been developed, and many problems have arisen in the practice of aviation cargo enterprises. Therefore, this paper discusses the development status and problems of the aviation logistics service supply chain. Then, strategic planning is developed for the future development of the aviation logistics service supply chain of aviation logistics enterprises.

First, China Southern Airlines Cargo, China Cargo Aviation, and SF Airlines are selected as the research objects. Then, SWOT analysis is performed on the three research objects. From the results of the SWOT analysis, four key issues in the aviation logistics service supply chain are summarized. Finally, TRIZ theory is used to analyze the four issues, and 11 strategies are designed for the aviation logistics service supply chain. The implementation sequence of the 11 strategies is divided into three phases to provide reference for the practice of aviation cargo enterprises: short-, medium-, and long-term. Among the provided strategies, S1, S3, S6, S9, S10, and S11 can reflect the characteristics of high customer participation in the aviation logistics service supply chain. S4 and S7 can reflect the requirements of customer-driven features through improved service product diversification. Automated operations can be established through S3, and changes in market demands can be addressed through S8, S9, S10, and S11 to achieve rapid response. Therefore, the improved aviation logistics process can fully reflect the characteristics of the aviation logistics service supply chain.

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