Research on Logistics Service Quality Evaluation Indexes of Automobile Special Steel of BJ Company

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June, 2021

Abstract

The development of iron and steel logistics is a major strategic measure for the iron and steel industry, especially for the iron and steel circulation industry, to change the mode of operation and development and to promote the development mode from extensive to intensive. The transformation and development of China's manufacturing industry from low-end to high-end improves the scientific and technological content and added value of the manufacturing industry and objectively requires China's iron and steel industry to develop from a low input-output ratio to a high-quality model to produce high-quality products needed by users, improve resource utilization efficiency and reduce defective products and customer complaints. At the same time, the establishment of competitive iron and steel enterprises and the establishment of e-commerce platform put forward the requirements of high-quality logistics for the service quality of third-party logistics enterprises. As a practitioner of high-quality steel logistics in China, BJ provides overall solutions for automotive steel processing and distribution. With the goal of becoming the highest-quality logistics service provider and logistics value creator, BJ is committed to providing customers at home and abroad with overall solutions for high-quality logistics, shipping agents, multi-modal transport, freight forwarders, warehousing, railways, roads and supply chains. It has formed a fully functional network advantage and focused on the development of high-quality logistics of automotive steel plate on the basis of market segmentation so as to provide customers with overall logistics solutions of high value-added services. Moreover, BJ is responsible for logistics services of steel high-quality supply chain. In order to adapt to the transformation of Chinese industry to high-end and green manufacturing, logistics industry must embark on a high-quality logistics road.

First of all, this thesis reviews literature, mainly from aspects of logistics service evaluation, iron and steel logistics service evaluation, logistics service supply chain, to understand the current research situation in related fields. Then, it introduces relevant theories used in this thesis, including total quality management, lean management, SCOR model, logistics industry green evaluation, service quality theory, and balanced scorecard. Thirdly, this research analyzes the current situation of logistics service quality evaluation of automotive special steel products of BJ. Fourthly, based on actual investigation, this thesis constructs the basic idea of the

design of service quality index system of high-quality logistics. Under the guidance of principles of convenience and rationality (high efficiency, customer satisfaction, cost saving and environmental friendliness), the indexes are selected from the aspects of safety, economy and greenness, and the index system is used to evaluate the quality and performance of BJ's high-quality logistics and other typical enterprises or industries. In this research, the evaluation index is applied to BJ, and the effect of service quality evaluation index of high-quality logistics in BJ is analyzed. This research found that after the application of the evaluation index of high-quality logistics, the key performance indexes of enterprise, such as return order timeliness rate, user complaint rate, transportation cost, greening and recycling, have been significantly improved. C5 hazard and risk control, C6 safety and security regulations enforcement rate, E2 freight information query service, and E4 supply chain cooperation rate, via the feedback of the management team, were found difficult to be assessed and implemented in reality. Therefore, it is suggested that while applying the evaluation index of high-quality logistics, quantitative measures should be taken to make up for its shortcomings.

This thesis realizes the innovation from the following two aspects:

(1) Perspective innovation: first of all, this thesis defines the concept of high-quality logistics, and systematically combs the index system of high-quality logistics, which is intended to reflect characteristics of systematization, digitalization, intelligence and transparency. High-quality logistics is the sublimation and in-depth exploration of lean and fine logistics, which enriches the research of quantitative analysis and performance evaluation in the field of iron and steel logistics and supply chain.

(2) Application innovation: introduce more mature theories such as total quality management, lean management and service quality theory into the field of high-quality logistics. Apart from embodying the four principles of traditional logistics: timeliness, accuracy, safety and economy, and highlighting the characteristics of green, ecological, systematic and innovative, it conducts empirical comparative analysis. That is, by comparing and analyzing the performance of enterprises before the implementation of quality evaluation scheme and after the implementation of quality evaluation scheme, we can not only find shortcomings in the operation of enterprise logistics services, but also test and revise the theoretical scheme with practice.

This research help enterprises solve the problem of logistics quality evaluation and enhance their market competitiveness, provide new ideas for performance evaluation in the field of iron and steel logistics, and the method of comparative study enriches case study in the field of logistics management to serve as useful exploration for the model of case study in this field.

Contents

1 Introduction

Iron and steel logistics is a unique branch of logistics industry, which solves the needs of goods transportation and warehousing between iron and steel production enterprises (steel mills) and downstream household appliances, automobiles and other manufacturing enterprises. Different from ordinary logistics enterprises, iron and steel logistics enterprises belong to asset-oriented and integrated service enterprises. Relevant enterprises not only have larger logistics equipment and facilities, but also need to provide integrated comprehensive service enterprises with strong logistics operation capacity. Besides, they need to make comprehensive use of their own transport capacity and external transport capacity to improve service efficiency[1] and achieve advantages of high efficiency and low cost, and to provide customers with long-term, professional and efficient modern comprehensive logistics services through scale and intensive management.

1.1 Research Background

1.1.1 Development Scale of China's Iron and Steel Industry

In recent years, the expansion rate of production scale of China's iron and steel industry has slowed down. In 2016, China's steel output was 1.0481345 billion tons, an increase of 1.30 percent over the same period last year. It is estimated that China's steel output in 2017 was 1.05 billion tons, an increase of about 1.20%.

[1] (Enterprise) service efficiency refers to the ratio of enterprise service resource input to enterprise service effect output and the effectiveness of enterprise service resource allocation. In this research, both service efficiency or efficiency shares this meaning.

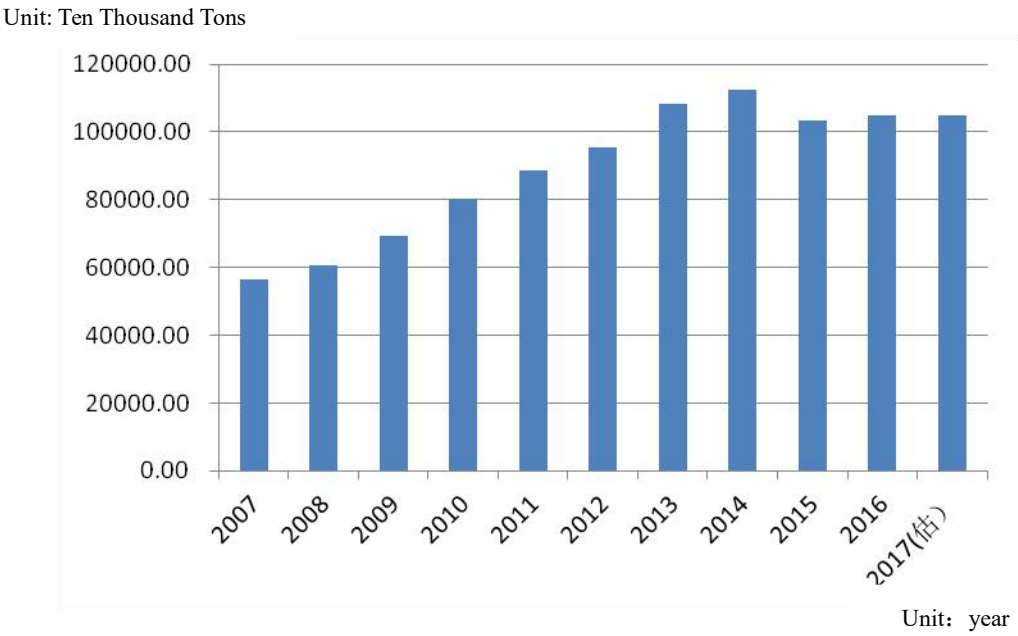

Figure 1.1 China 's Steel Output from 2007 to 2017 (Unit: 10,000 tons)[2]

Source: Website of China Bureau of Statistics

1.1.2 Development Trend of Iron and Steel Logistics in China

In recent years, the growth rate of the total cost of social logistics in China has declined. In 2016, the total cost of social logistics was 11.1 trillion yuan, an increase of 2.9% over the previous year. From January to November 2017, the total amount of social logistics nationwide was 229.9 trillion yuan. It is preliminarily estimated that the total cost of social logistics for the whole year[3] of 2017 is about 11.8 trillion yuan[4].

China is the country with the largest scale of iron and steel logistics in the world. Benefiting from the stimulation of domestic demand driven by state investment, China boosts a huge logistics flow in the field of iron and steel logistics. It is estimated that the size of China's iron and steel logistics market is about 5.69 billion tons in 2016 and about 4.149 billion tons in the first three quarters of 2017, and that the size of China's iron and steel logistics market will exceed 8.5 billion tons in 2023.[5]

At present, automobile special steel logistics belongs to a branch of iron and steel logistics, which is characterized by high efficiency, high quality, and

[2]Data source：https://www.sohu.com/a/195054914_775892

[3]Social logistics generally refers to macro logistics. It refers to the overall logistics activities of social reproduction, which is to understand and study the logistics activities from the perspective of social reproduction as a whole. Its main characteristics are comprehensive and overall.

[4]Data source：https://www.chyxx.com/industry/201708/548337.html

[5]Data source：https://www.qianzhan.com/analyst/detail/220/180112-21f5ef35.html

environment-friendliness. First, high efficiency. Take the needs of users as one of the most important aspects: for example, some users order ordinary goods, then improve the logistics speed; while other users want to follow the production beat, then deliver goods according to the needs of manufacturers. Second, high logistics quality. That is, users want to ensure the quality of the product (steel coil), and avoid the appearance of outer packaging damage, collision, and scratches. Third, environment-friendliness. For protective and gasket materials, the aim is to ensure product quality, save costs and to realize environmental protection.

1.1.3 Diversified Development Mode of Iron and Steel Logistics

In recent years, China's iron and steel logistics has made a good exploration in innovative business model, and formed a diversified development model of iron and steel logistics.

Table 1.1 Diversified Development Model of Iron and Steel Logistics

Model	**Specific Description**
Trade+logistics	From the source of raw material procurement and supply, to provide the whole logistics service mode of raw material procurement, warehousing and transportation, circulation and processing, information service and integrated distribution for the iron and steel industry.
Logistics+Finance	Some logistics enterprises with warehousing and logistics conditions begin to develop logistics financial services such as warehouse receipt pledge, which extends the logistics value-added chain.
Trade+Circulation processing	Some enterprises in close contact with the end customers began to develop circulation processing and distribution services, expanding the field of iron and steel logistics business.
Emerging Iron and Steel Logistics Park. (integrated supply chain logistics)	Traditional market integration and upgrading, a collection of trade, warehousing, processing, distribution, logistics, finance, information services in one, to form a new supply chain.
Platform+Logistics (O2O)	The use of e-commerce platform to complete the business flow process, the use of logistics to complete processing and distribution.

Data source: forecast of the development prospect of China's logistics industry in 2018, iron and steel logistics rising from the wind.

https://www.qianzhan.com/analyst/detail/220/180112-21f5ef35.html

Generally speaking, China's iron and steel logistics processing is still in its infancy, and is still at a low-end level. Compared with the advanced level of foreign countries, China lags far behind. For example, steel logistics processing in Western

Europe, Japan and the United States are mature industries. In the future, China's iron and steel industry will enter a post-expansion period. At this stage, its industrial development is characterized by the coexistence of expansion and transformation. On the one hand, under the condition of accelerating the process of urbanization and industrialization, China's iron and steel market is still in the stage of expansion, but the speed of market expansion begins to slow down; on the other hand, the market is facing the transformation of mode of operation, which can form a reverse forcing mechanism[6] to accelerate the development of iron and steel logistics.

1.1.4 Development Characteristics of Iron and Steel Logistics in China

In the 1950s and 1980s, the layout of China's iron and steel production was the construction of steel mills close to mines (iron ore and coal mines), and most of the iron and steel enterprises were distributed in inland areas, while China's steel consumption market was mainly concentrated in the economically developed coastal areas, namely, the Yangtze River Delta, Pearl River Delta and Bohai Rim areas. The imperfect match between the steel producing area and the consumer market results in a huge transport demand[7] for iron and steel logistics.

The low concentration of the industry makes it difficult to centralize and coordinate the transportation of raw materials in the supply chain and the sales and transportation of steel products, which leads to a waste of resources and an increase in logistics costs. In 2019, the industrial concentration of the top 10 iron and steel enterprises in China was only 36.8%, the concentration of the steel industry of more than 10 million tons was only 52.38%, and the concentration of the top four iron and steel enterprises with output was only 21%. The concentration of iron and steel enterprises in the top four in Europe, America, Japan and South Korea is more than 60%. With the merger and reorganization of China's steel enterprises, China's steel capacity concentration is expected to further increase[8]. In the channels of steel sales,

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[6] The so-called reverse forcing mechanism borrows the core of reverse forcing mechanism in the super-economic issuance of money, which means that the investment and financing function of state-owned enterprises is insufficient, causing the government's investment and financing behavior to forcibly replace them, which further leads to the flow of bank credit funds to state-owned enterprises through finance, forming forced loans. On the other hand, because of the soft financial constraints, the state-owned enterprises are easy to form non-performing liabilities to the banks (on the contrary, the non-performing assets of the banks). The meaning here is: changes in the downstream market promote changes in upstream logistics suppliers.

[7] Source: anonymous. Is the steel industry really a nightmare for logistics enterprises? A well-written national pillar industry [EB/OL]. https://www.sohu.com/a/312255730_747469.

[8] Source: anonymous. There is still much room for improvement of capacity concentration in China's iron and steel industry.

however, the proportion of direct supply is still on the low side, for the traditional steel sales are mainly based on the hierarchical distributor agent distribution mode, and the process of steel reaching the end user is too cumbersome, with high logistics costs and low efficiency.

Combined with the operation system of China's iron and steel production and marketing chain, it can be seen that at present, China's iron and steel logistics industry shows the following characteristics:

(1) Mismatch between supply and demand structure.

Due to the requirements of scale effect, the output of a single steel plant is high, and the single batch sales are large (usually refuse sporadic orders); while the steel end-users are extremely scattered, even large users often use small batches and high-frequency orders to reduce inventory costs. There are great differences in logistics volume and logistics frequency between supply and demand, which cannot be matched directly.

(2) The capital flow needs to be connected by steel traders.

Upstream steel mills require payment before goods and end users require goods before payment. The convergence of upstream and downstream capital flows needs to be completed through steel traders. Especially in recent years, when there is difficulty for steel mills to make profits and there is great financial pressure, most steel mills are looking for steel traders with strong financial strength to provide them with advance fund. In 2014, the proportion of customers who pay in advance is as high as 85% and even 90%, and the phenomenon of advance fund is very common.

(3) The segments of logistics chain are obvious.

Due to the mismatch between the supply and demand structure of iron and steel logistics, the typical logistics chain is obviously divided into two sections: the first section flows from steel mills to major steel trade markets (or steel logistics parks), dominated by steel mills and a small number of first-class steel traders. The latter section is diverted from the steel market to end-users, dominated by a large number of secondary steel traders. Through the segmented services of steel traders at all levels, the logistics and capital flows of upstream and downstream can be connected smoothly, and only a small number of large end-users can obtain direct sales services from steel mills.

[EB/OL].https://baijiahao.baidu.com/s?id=1677869441385608810&wfr=spider&for=pc,2020-09-15/2021-03-24.

(4) There is still vacancy in value-added services.

In the modern iron and steel logistics system, there are still few value-added services in the chain of warehousing, processing, distribution and transportation. The services available are limited in number and most of them are only the primary shearing processing in the warehousing link (including uncoiling, leveling, sizing, and continuous cutting), and the proportion of customized processing and distribution is still low. With the development of iron and steel e-commerce, Internet of things and Internet finance, the matching value-added services that can be provided by logistics still need to be developed and improved.

Nowadays, Chinese iron and steel circulation enterprises have changed the simple way of one buy and another sell in the past, extended to both ends of the trade and supply chain, and expanded the functions of purchasing logistics, logistics distribution, circulation processing, logistics finance, which has promoted the rapid development of China's iron and steel logistics.

Since its establishment in September 2015, Maanshan Iron and Steel Logistics Company has greatly improved its operating performance (asset caliber): from 2016 to 2020, revenue and profit have tripled, the rate of return on net assets has increased from 10% to 14%, and labor efficiency has improved significantly, with per capita revenue increased from 0.82 million yuan to 2.53 million yuan. While making achievements, under the guidance of actively tamping the national 5A comprehensive service-oriented logistics model, the company has scientifically worked out exciting goals for the next five years, that is, to create a sandwiched service model of the integration of “heaven and earth” of base finished goods logistics, and to become a practitioner and replicable demonstrator of the new logistics model of Baowu base in China; build and layout the garden transportation system of warehouse and port stations in Anhui and its surrounding areas, provide support for the iron and steel ecosystem and become the forerunner of the integrated logistics service system; give full play to the advantages of logistics+assets, expand social business, improve asset efficiency, and become the pioneer of the regional logistics market.

Relying on the advantages of the group's business network and supply chain finance, Hegang Logistics Caofeidian Cloud Business has enhanced its efficiency capacity, increased the cargo throughput of the two terminals of Caofeidian and Huanghua Port by 1.1 million tons, increased the business income of the two ports by 22 million yuan, and raised its own trade efficiency to more than 9 million yuan,

which has become a new trade efficiency-generation sector of Hegang logistics. Through a series of combined value-added services, such as steel plant credit, business tracking, shipment tracking, cargo inspection supervision, logistics and transportation, and data analysis, Ouye provides downstream customers with steel plant resource platform sales services. By the end of March 2019, the supply chain business had served more than 800 customers and submitted purchase orders of about 8.5 million tons to 92 group steel mills. TISCO (Taiyuan Iron & Steel Co., Ltd.) has realized the integration of railway transport+production and commerce+supply chain finance. According to a combination of dual-flow demand for commodities such as iron ore, stainless steel and coke, over-line two-way heavy-load 35-ton open top container trains suitable for the integration of cargo categories in ports such as Tianjin Port and Huanghua Port and the special railway line of TISCO was initiated, which cannot only give full play to the low-cost advantage of carrying heavy cargo back and forth, but also conveniently realize the benefits of the whole railway supply chain through multimodal transport, car-free transport and cloud service platform.

However, at present, the logistics cost rate of China's iron and steel industry is 11%, which is much higher than 6%[9] in developed countries. The existing low-level operation of China's iron and steel logistics cannot meet the rapid growth of production and consumption demand, which has become one obstacle to the rapid development of the industry. A major overturning accident occurred in Wuxi Viaduct in 2019, and a special campaign called *Hundred-ton King* to control overloading was carried out in various localities. Starting from December 16, 2019, China uniformly implemented non-stop weighing test at the entrance of closed highway toll stations, forbidding illegal overloaded trucks from entering expressways. Besides, iron and steel logistics enterprises are advised to actively use Internet of things technology and digital technology to control overloaded vehicles to ensure logistics service quality and safe operation.

In iron and steel logistics, high-quality logistics has become an important part of the excellent operation of the supply chain in the automobile industry. Based on the total quality management, lean management, SCOR model, logistics green evaluation, service quality theory and balanced scorecard, and combined with the experience of

[9] Lu Lanqing. Forecast of the Development Prospect of China's Logistics Industry in 2018-Iron and Steel Logistics Takes Advantage of the Times [EB/OL]. Https://www.qianzhan.com/analyst/detail/220/180112-21f5ef35.html

Shanghai BJ Company (hereinafter referred to as BJ, because trade secrets are involved, the real company name is hidden in this thesis.) in implementing high-quality logistics service for years, this thesis investigates the key factors affecting the quality of automotive special steel high-quality logistics, constructs the quality evaluation index system of high-quality logistics based on empirical research, establishes the index evaluation model and method, and puts forward feasible strategies to improve the quality of high-quality logistics.

1.2 Research Purpose

The development of iron and steel logistics is a major strategic measure for the iron and steel industry, especially for the iron and steel circulation industry to change the mode of operation and development. Since 2017, thanks to the better-than-expected recovery of the global economy and the steady development of the domestic economy, steel consumption in China's construction, machinery, automobile, energy, shipbuilding, home appliances, containers and other major downstream industries has maintained a good growth trend, promoting the rapid growth of the overall demand for steel in China. According to estimates, China's actual steel consumption in 2017 was 725 million tons, an increase of 7.7 percent over the same period last year. In 2018, China's economic development will maintain a steady growth trend, and the demand for steel in construction, machinery, automobile, shipbuilding, home appliances, containers and other industries will continue to grow.

Therefore, the transformation and development of China's manufacturing industry from low-end to high-end objectively requires the development of China's iron and steel industry from extensive to high-quality mode, so as to produce the high-quality products that users need. At the same time, the establishment of competitive iron and steel enterprises and the establishment of e-commerce platform put forward the requirements of high-quality logistics for the service of third-party logistics enterprises, while BJ undertakes the logistics services of steel high-quality supply chain. In order to adapt to the transformation and development of Chinese industry to high-end and green manufacturing, logistics industry must take the route of high-quality logistics.

As a practitioner of high-quality steel logistics in China, BJ provides overall solutions for automotive steel processing and distribution. With the goal to become

the highest-quality logistics service provider and value creator, BJ is committed to providing customers at home and abroad with overall solutions for high-quality logistics, shipping agents, multimodal transport, freight forwarders, warehousing, railways, roads and supply chains. It has formed a fully functional network advantage and focused on the development of automotive steel plate high-quality logistics on the basis of market segmentation, so as to provide customers with overall logistics solutions of high value-added services. The dynamic and random nature of the logistics market is very strong. Information such as market changes and logistics needs can also be obtained from big data, and resource allocation can be planned and adjusted in time. At the same time, logistics route planning can be optimized, logistics costs can be reduced and time effectiveness can be improved.

BJ, however, still has weaknesses, such as a lack of logistics professionals, the degree of adhesion with customers needs to be improved, the supply chain process needs to be further enhanced, and energy saving and environmental protection is insufficient. All these, which are related to logistics service quality, require enterprises to assess the transportation quality, safety, greenness and other aspects in daily operation. The construction of a complete set of systematic quality evaluation system of high-quality logistics is not only helpful to the assessment of all levels of high-quality logistics, but also to provide guidance and scientific quantitative basis for the formulation of follow-up management measures. Moreover, it is convenient for enterprises to verify and compare the effects of follow-up management measures, and make enterprises benefit, which is conducive to the sustainable development of enterprises. The establishment of quality evaluation system cannot only lay the foundation for the development and improvement of high-quality logistics, but also promote the transformation and upgrading of enterprises in the same industry and improve the service level of China's third-party logistics industry.

The purpose of this thesis can be summarized as the following four aspects:

- Reduce cost and increase efficiency - promote the integration and optimal allocation of logistics resources in the iron and steel industry, and improve the utilization rate of iron and steel logistics resources.
- Accurate management - with professional and core competencies, directly take efficient action, practice the company's business philosophy, and implement accurate policy.
- Bench-marking management - bench-marking logistics quality evaluation,

systematic, green, low-carbon evaluation standards, bench-marking management to reduce the overall cost of iron and steel logistics supply chain.

- Low-carbon and green - from the perspective of greenness, ecology, systematization and innovation, and taking into account the economic, ecological and social benefits, this research demonstrates the greatest value.

Specifically, this research aims to solve the following problems:

(1) The present situation of the logistics service evaluation system of BJ. In what aspects is there a discrepancy between this system and the development strategy of high-quality logistics of BJ?

BJ, with the customer as the center, provides customized logistics services for customers, and creates a supply chain logistics solution for key customers. On the premise of providing the best service to customers, high-quality logistics realizes the strategy of lowest cost and improves service quality: the index value of service improvement is usually evaluated by the satisfaction rate of customer demand, but the final evaluation index is the annual revenue of enterprise; high-quality logistics means to improve the overall supply chain management level of users and enhance the competitiveness of the high-quality logistics market.

At present, there is a gap between the evaluation system and the development strategy of high-quality logistics, which needs to be improved. Therefore, under the guidance of high-quality logistics, the evaluation of BJ current logistics services can help BJ to grasp the current situation of logistics services and find the current development situation of high-quality logistics and the mismatch with strategic objectives, so as to facilitate the establishment of next development direction and decision-making of BJ.

(2) How to select the logistics service evaluation index scientifically and effectively so as to meet the strategic development requirements of high-quality logistics?

At this stage, BJ's evaluation indexes do not fully reflect the quality requirements of high-quality logistics, which needs to be further improved. The construction of the service quality evaluation index system of automobile special steel high-quality logistics is the core of this thesis. Only by designing a scientific index system can we accurately evaluate its service quality to better meet the requirements of the strategic development of high-quality logistics. In order to ensure the accuracy and objectivity of the service quality measurement of high-quality logistics of automobile special

steel, this thesis is based on the characteristics of high-quality logistics service of automobile special steel, follows the basic principle of the construction of evaluation index system, and starts from the practical application value to establish a reasonable evaluation index system of high-quality logistics service quality of automobile special steel. Then what kind of construction principles and processes should be followed, and how to formulate the selection scheme of indexes become an important content.

(3) How to implement the new logistics evaluation system to improve the logistics service level of BJ?

On one hand, the formulation of programme is very important; on the other hand, whether the programme can be implemented directly determines the effectiveness of the programme. The high-quality logistics service system of automobile special steel is a system which takes the customer logistics demand as the starting point, and different logistics organizations go through the service process of mutual supply and demand. Then, how to implement the evaluation of this service system and promote the improvement of logistics service level has become another important content. Besides, what are the objectives, specific measures, implementation steps and safeguard measures for the improvement of logistics service quality become another important content.

In short, the construction of the index system in this thesis is based on questionnaires, research and interviews, with reference to the relevant literature for collation and analysis, coming from the practice in China. These indexes have been screened, used and precipitated for many years in practice. As high-quality logistics belongs to delicacy management, the content involved is relatively wide and complex. In that case, it is normal that these evaluation indexes seem to be miscellaneous, but in fact it contains all the main aspects of logistics index evaluation and has inherent logical relations. In the research, effective indexes are used and refined to make the index system more systematic and logical.

1.3 Research Significance and Methodology

At present, the focus of the development of China's iron and steel logistics industry is to improve the service system. With the help of advanced information technology, through the resource integration of iron and steel logistics infrastructure network, iron and steel logistics organization network and information network, an

efficient iron and steel logistics service system is established to give full play to the integration effect of iron and steel logistics resources and to improve the utilization efficiency of iron and steel logistics resources. This thesis takes the high-quality logistics of automobile special steel of BJ as the starting point, takes reducing logistics cost and improving logistics service quality as the criterion, and studies the index system and application of high-quality logistics combined with the theories of lean management and total quality management, which complements and enriches the application of the theory in this field in industry practice. BJ evaluates the establishment of index of high-quality logistics, which plays a quantitative and guiding role, so that the quality control measures of high-quality logistics service can effectively promote the operation quality of the enterprise.

1.3.1 Theoretical Value

Taking the logistics of automobile special steel of BJ as the starting point and on the basis of relevant theories of total quality management, lean management and service quality theory, this thesis explores the mode and operation mechanism of the integration of logistics resources between supply and demand, evaluates the service quality of iron and steel logistics, further enriches the theory of logistics quality evaluation, and improves the theoretical system of iron and steel logistics.

(1) Based on the Perspective of Logistics Service Supply Chain

At present, researches on logistics service quality focus on logistics service providers, but this research aims at a specific enterprise or industry to study logistics service quality from the perspective of the relationship between logistics supply and demand. This thesis studies the integration of iron and steel logistics resources and service quality from the perspective of the relationship between supply and demand, and integrates iron and steel logistics service supply organization and demand organization into a network, that is, iron and steel logistics supply and demand network, and then a new perspective of logistics service quality evaluation is established.

(2) Based on the Characteristics of Green Sustainable Development

The quality evaluation system proposed in this thesis not only embodies the four principles of traditional logistics: timeliness, accuracy, safety and economy, but also highlights the characteristics of green, ecological, systematic and innovative, and economic, ecological and social benefits are taken into account. It enriches the case

study and practical application in the field of iron and steel logistics, which is helpful to the theoretical discussion on the sustainable development of iron and steel logistics enterprises.

(3) Based on Systematic Research Ideas

The research idea of this thesis comes from practice and goes to practice, that is, to find problems in the practice of enterprise management, then use relevant theories and methods to analyze the problems and put forward solutions, and finally apply this scheme to practice to solve enterprise problems, and verify and modify the theoretical scheme. The thesis not only focuses on the isolated and single logistics link, but also looks at the whole logistics service system from the perspective of system, and optimizes the logistics service system as a whole.

1.3.2 Practical Significance

This thesis expects that the proposed systematic, scientific and reasonable quality evaluation scheme can provide a useful reference for enterprises in the iron and steel logistics industry, so that more enterprises can improve efficiency and market competitiveness, and achieve long-term sustainable development.

(1) It is Beneficial for BJ to Reduce Cost and Increase Efficiency.

At present, there are problems in the development of iron and steel logistics industry, such as uneven distribution of logistics resources, unreasonable allocation, single logistics service mode, serious homogeneous competition, high logistics cost, and lack of effective cooperation among logistics enterprises. On one hand, some iron and steel logistics resources are idle; on the other hand, other iron and steel logistics needs cannot be met. Therefore, using high-quality logistics as an example and taking the quality evaluation of automobile special steel logistics as the starting point to promote the integration and optimal allocation of logistics resources in the industry cannot only reduce the proportion of iron and steel logistics resources, but also meet the actual needs of iron and steel logistics, and scientifically and effectively improve the utilization rate of iron and steel logistics resources.

(2) It is beneficial to the precision management of BJ, rewarding the best and punishing the lazy.

Precision management is an idea and a culture. Precision refers to strong professional ability and core competitiveness. Precision also means that the enterprise can have a clear and bold goal and accurately hit the key needs of customers. The

main spirit of precision management is to directly take efficient action and implement the company's willpower by virtue of professional and core competencies. Precision management is to establish the core competitiveness of the enterprise and an effective and efficient team to support the definition of enterprise survival, to specify the vision through clear goals, to deal with the environment and competition with plans and strategies, to guide the enterprise to the future and even teach and get the consensus and recognition of the whole staff. In this thesis, by constructing the quality service system index of high-quality logistics of automobile special steel, the future development goal of the enterprise is determined and quantified so as to facilitate practical assessment, reward excellence and punish laziness to promote the realization of the company's development goal of high-quality logistics.

(3) It is beneficial to the bench-marking management of BJ and improve the quality of logistics service.

Through the evaluation of high-quality logistics of automobile special steel, especially the characteristics of systematic, green and low-carbon, it cannot only reduce the cost of iron and steel logistics to a certain extent, but also realize the win-win situation of all parties in the iron and steel supply chain so as to promote the healthy development of iron and steel logistics industry. Moreover, it is in line with the current and future development trend of iron and steel logistics, and responds to the goal of national ecological civilization construction to promote the harmonious coexistence and sustainable development of relevant enterprises and society.

1.3.3 Research Methodology

This thesis selects topics from practice and applies multiple theories, therefore multiple theories are refereed to here, such as total quality management, lean management, balanced scorecard and service quality theory, to study the service quality evaluation of automobile special steel high-quality logistics, mainly via the following research methods:

(1) The method of combining literature review with practical investigation.

This thesis summarizes the literature from the aspects of iron and steel logistics, logistics service supply chain, low-carbon iron and steel logistics, and green direction optimization. On the basis of reviewing the existing research, combined with the two aspects of supply and demand, through the actual investigation of BJ, we have a more comprehensive and clear understanding of the service status and actual demand of the

automobile special steel high-quality logistics of BJ, and on this basis to build a suitable service quality evaluation system for BJ.

(2) The method of combining qualitative analysis with quantitative analysis.

Through the qualitative analysis of the development status of the iron and steel logistics industry, the domestic and foreign literature of the iron and steel logistics service and BJ, and drawing lessons from relevant research results, this thesis puts forward the improvement direction and implementation strategy of the automobile special steel product logistics of BJ. In the iron and steel logistics quality and performance evaluation, the corresponding analysis is conducted through the relevant mathematical methods and models.

(3) The research method of combining theory with practice.

From the development status of iron and steel logistics industry and the actual operation of BJ, this thesis puts forward the theoretical problem of high-quality logistics quality evaluation of automobile special steel, and comprehensively uses theories such as total quality management, lean management, balanced scorecard, and service quality theory, to study the service quality evaluation and implementation countermeasures of iron and steel logistics, so as to guide the actual operation of the industry. At the same time, through the case study of BJ, the rationality and feasibility of the theory is verified.

The details can be shown in figure 1.2.

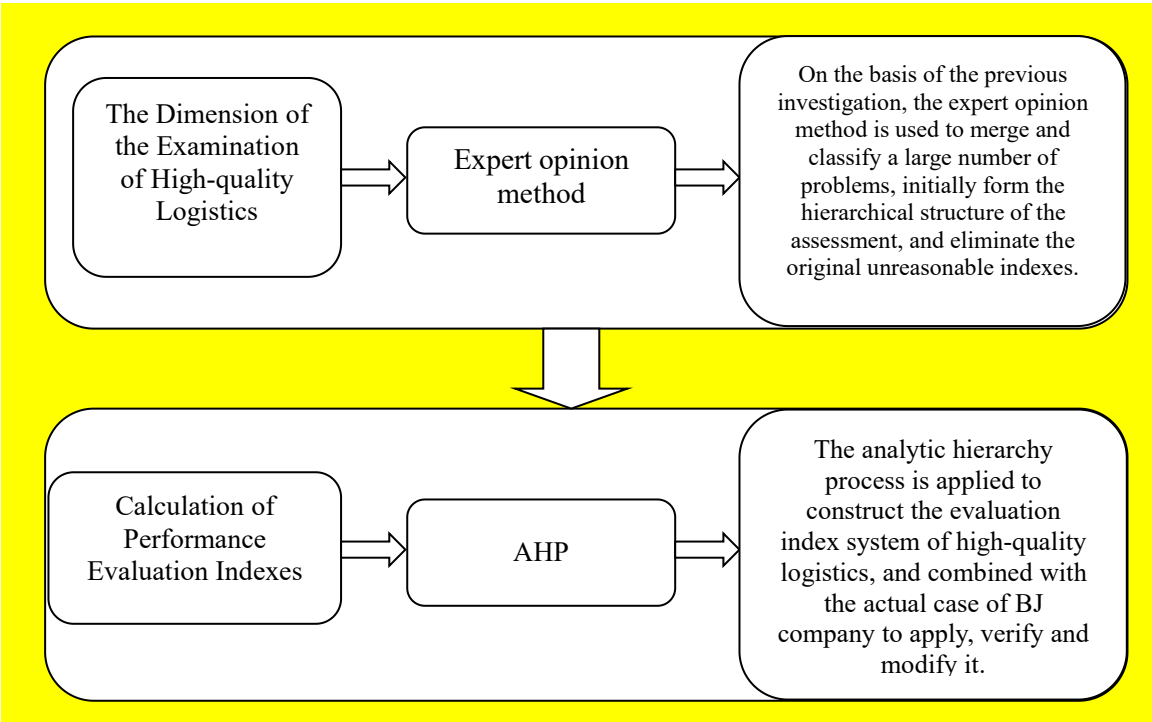

Figure 1.2 Specific Research Methods of This Thesis

Compared with using the whole industry as the research object, this thesis starts with a specific case, which is easier to control. Although each enterprise has its own uniqueness, as a typical case of the iron and steel logistics industry, the research results of BJ can be applied to enterprises in the same industry, which is not limited to promoting the development of BJ itself.

1.4 Research Framework and Novel Research Contributions

1.4.1 Research Framework

This thesis focuses on the logistics service quality evaluation index of automobile special steel of BJ, uses the research methods of literature review and practical investigation, qualitative analysis and quantitative analysis, theory and practice, as well as methods of reading a large number of references, collecting original data, sorting out internal documents, and summarizing related research. Based on the analysis of the present situation and existing problems of the high-quality logistics service of automobile special steel of BJ, the evaluation index system of logistics service quality of automobile special steel is put forward, and the system is applied to the logistics service practice of BJ. Compared with the enterprise performance and results before and after the application of the scheme, the aforementioned quality evaluation index system is verified and revised, and the improvement direction and implementation countermeasures of the logistics service of the company are put forward (This part refers to the method of writing from Zhou Zhengsong. Research on the Construction and Application of Service Quality Evaluation Model of Logistics Enterprises [D]. Jiangsu University, 2012).

The research idea of this thesis is as follows:

Chapter One mainly introduces the research background, research purpose, research significance and methodology, main framework and innovation. First of all, starting with the current situation of the development of China's iron and steel industry, the characteristics and problems of China's iron and steel logistics, this thesis introduces the social background of BJ steel logistics. Then, it introduces the research significance, research methodology, research framework and innovation of this thesis.

Chapter Two is the literature review, mainly from the aspects of logistics service evaluation, iron and steel logistics service evaluation, and logistics service supply

chain.

Chapter Three mainly introduces the relevant theories used in this thesis, including total quality management, lean management, SCOR model, logistics green evaluation, service quality theory, and balanced scorecard. Because of the particularity of iron and steel logistics: economy, cost, safety, environmental protection, and customer experience, the above single theory cannot fully support the whole assessment system. This thesis will increase the assessment of green, systematic and other contents on the basis of comprehensive consideration of the above theories, and how to apply these theories in the research of BJ is analyzed in detail.

Chapter Four is the analysis of the current situation of logistics service quality evaluation of automotive special steel products of BJ. This part expounds and summarizes the background of BJ, the development status of automotive special steel quality logistics of BJ and the current situation and characteristics of service quality evaluation index, finds out the current problems of service quality evaluation index of automotive special steel logistics of BJ, and ~~finally~~ points out the necessity and urgency of improving logistics service quality evaluation index.

Chapter Five is the design of logistics service quality evaluation index of automobile special steel of BJ. Based on the theory of Chapter Three and the actual investigation of Chapter Four, this chapter will construct the basic idea of the design of the service quality index system of high-quality logistics, and select the indexes from the aspects of safety, economy and environment-friendliness under the guidance of the principles of convenience and rationality, and use the index system to measure and evaluate the quality and performance of BJ high-quality logistics and other typical enterprises or industries. This thesis first collects the possible indexes through interviews, questionnaires and literature analysis, uses the expert opinion method to screen, then uses the AHP method to assign the weight to the determined indexes, and finally gives the synthesis method of the index.

Chapter Six is the improvement strategy of logistics service quality evaluation of automobile special steel products of BJ. This part first expounds the principles and objectives of service quality evaluation and improvement, and then points out the measures and implementation steps for evaluation and improvement. This part is based on the evaluation results of Chapter Five and is the specific performance improvement countermeasures and suggestions put forward to BJ.

Chapter Seven is index application: the effect analysis of the service quality evaluation index of high-quality logistics in BJ. This part first analyzes the key performance before the application and implementation of the evaluation index of high-quality logistics, then analyzes the key performance after the application of the evaluation index of high-quality logistics, and finally evaluates and modifies the evaluation index of high-quality logistics.

Chapter Eight is conclusion and prospect. This chapter, a summary and reflection of the above-mentioned research, points out the characteristics and shortcomings of this study and the direction for future research.

The reason for choosing this method is that the research theme of this thesis comes from practice and is finally applied to practice. Therefore, this thesis first uses the questionnaire to collect the index system, then forms the evaluation index system through the screening and scoring of practical experts, which is applied and revised in BJ. The goal of combining theory with practice has been achieved.

The technical route of this thesis is shown in figure 1.3.

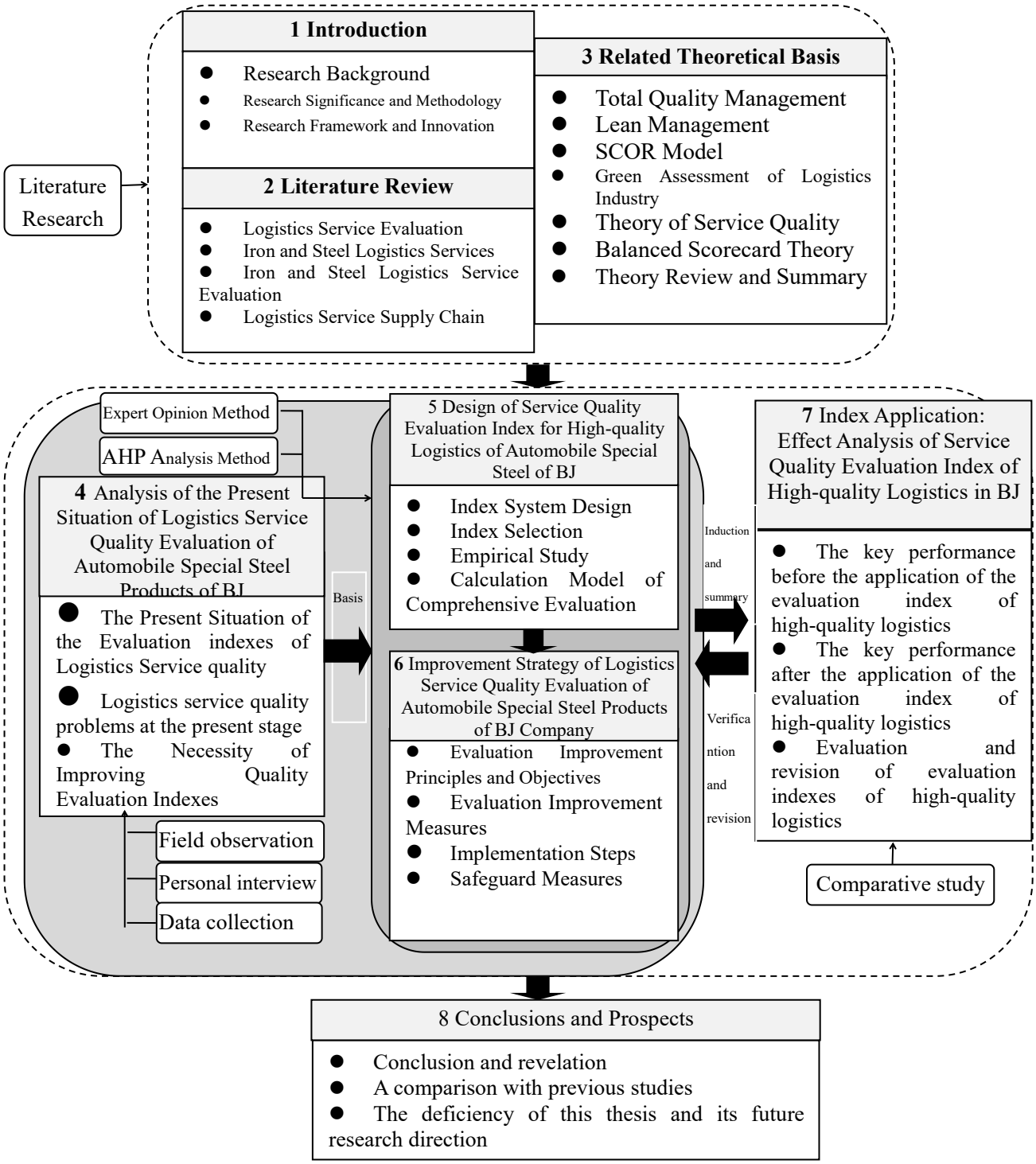

Figure 1.3 Technical Route of this Research

1.4.2 Novel Research Contributions

This thesis realizes the innovation from the following two aspects:

(1) Perspective innovation: first of all, this thesis defines the concept of high-quality logistics, and systematically combs the index system of high-quality logistics, which intends to reflect its characteristics of systematization, digitalization,

intelligence and transparency. High-quality logistics is the sublimation and in-depth exploration of lean and fine logistics, which enriches the research of quantitative analysis and performance evaluation in the field of iron and steel logistics and supply chain.

(2) Application innovation: introduce more mature theories such as total quality management, lean management and service quality theory into the field of high-quality logistics. In addition, it not only embodies the four principles of traditional logistics: timeliness, accuracy, safety and economy, but also highlights the characteristics of green, ecological, systematic and innovative, and empirical comparative analysis can be conducted. That is, by comparing and analyzing the performance of enterprises before the implementation of quality evaluation scheme and after, we cannot only find the shortcomings in the operation of enterprise logistics services, but also test and revise the theoretical scheme with practice.

This study can help enterprises solve the problem of logistics quality evaluation, enhance their market competitiveness, and provide new ideas for performance evaluation in the field of iron and steel logistics. Moreover, the method of comparative study enriches the case study in the field of logistics management, and makes a useful exploration for the model of case study in this field.

1.5 Chapter Summary

First of all, this chapter summarizes the current situation of China's iron and steel logistics from aspects of the development scale of China's iron and steel industry, the development scale and the development model of China's iron and steel logistics, and analyzes the characteristics and existing problems of the development of China's iron and steel logistics.

This chapter further points out the theoretical value of this thesis from the perspective of logistics services based on supply chain, the characteristics of green, ecological and systematic, and the research ideas of comparing the effects before and after the application of evaluation schemes. It also points out the practical significance from three aspects: improving the utilization rate of iron and steel logistics resources, improving the efficiency of iron and steel logistics related enterprises, and promoting the healthy development of the industry. The main research methods are: the combination of literature review and practical research, the combination of qualitative

analysis and quantitative analysis, and the combination of theory and practice.

Finally, this chapter describes the main research framework and innovation.

This part is an overview of this study, which explains in detail the writing background, purpose and significance of writing, methods adopted and innovation. The significance of this part is to enable readers to have a general understanding of this research.

2 Literature Review

At present, the research on iron and steel logistics service quality evaluation involves four aspects: first, logistics service evaluation; second, iron and steel logistics service; third, iron and steel logistics service evaluation; fourth, logistics service supply chain. Here is a summary:

2.1 Logistics Service Effect Evaluation

Logistics Service Supply Chain (LSSC) is the key link of service supply chain (Cui Aiping, Liu Wei and Zhang Xu, 2008). Generally speaking, the theory of logistics service supply chain is embodied in performance management, selection of logistics service providers, logistics service supply chain structure, and logistics service supply chain coordination mechanism.

2.1.1 The Proposal of Evaluation Index

PRTM (2003), the authoritative institution of supply chain management, put forward several comprehensive indexes of how to measure the supply chain performance management of general enterprises in the classical model of SCOR. The details are as follows: the satisfaction of enterprise order and delivery, the flexibility of production and manufacturing, the rapid response time of the whole supply chain, the management cost of enterprise logistics activities, the production efficiency of added value, the turnover days of enterprise cash flow, the inventory cycle of enterprise supply turnover and the turnover rate of enterprise assets.

B. M. Beamon (1999) constructed an enterprise performance management system that includes three aspects, resources, flexibility and output. The indexes of resources are: manufacturing cost, distribution and sales cost, inventory cost, total cost and return on assets, while indexes of enterprise flexibility include: product flexibility, quantity flexibility, time flexibility and mixed flexibility. Output indexes

include profit, sales, customer response time, order satisfaction rate, manufacturing lead time, just-in-time delivery, delivery errors, out of stock and customer complaints. Brewer and Speh (2000) put forward a set of performance management system based on balanced scorecard for supply chain management of modern enterprises, and tried to assess the actual performance of supply chain management from four aspects of the enterprise, specifically (1) the goal of enterprise supply chain management; (2) the actual interests of final customers; (3) the overall financial interests of enterprise; (4) the medium-and long-term development of enterprise supply chain management.

J. D. Camm and T. E. Chorman's (1997) world's leading management consulting company recommends professional third-party logistics enterprises and third-party suppliers to adopt seven indexes for comprehensive performance evaluation, including (1) enterprise just-in-time transportation rate; (2) enterprise just-in-time delivery rate; (3) enterprise transportation process accuracy and traceability; (4) customer order completion rate; (5) enterprise project activity completion rate; (6) enterprise inventory accuracy; (7) the damage rate of the goods. Gunasekaram (2001) comprehensively considers the supply chain cooperation and relationship, order execution plan, production and manufacturing level, enterprise logistics and distribution, customer long-term service and satisfaction, and accounting and financial management, puts forward a set of enterprise performance management evaluation index system, and divides indexes in the system into three levels: strategy, tactics and operation.

Ma Shihua (2000) collected general statistical measurement indexes for enterprise performance management system, including manufacturing and product quality, upstream and downstream customer service and satisfaction, enterprise asset management and total operating cost, and tried to start from how to build performance evaluation indexes for enterprise performance management to enhance the overall competitiveness of enterprises. Xu Xianhao et al. (2000) put forward a set of comprehensive management evaluation indexes for the whole enterprise supply chain business process performance. It mainly includes: the index of enterprise production and marketing rate, the absolute deviation index of enterprise average production and marketing, the ratio of enterprise output to demand, the cycle index of product production in the whole supply chain, the quality index of the product in the whole supply chain, the cost index of the core products of the whole supply chain and the total operating cost index of the whole supply chain. Ma Shihua et al. (2002) put

forward how to use scientific and reasonable balanced scorecard in performance management and analyzed the relationship between the performance of upstream suppliers and downstream manufacturers. They even discussed how to establish a series of performance management systems to meet the needs of final customers and the market as a whole and at them same time ensure the steady growth of the performance of the whole supply chain.

Chen Zhixiang (2004) focused on the four aspects of information, logistics, capital flow and work coordination in the coordination of supply and demand among enterprises, constructed a set of multi-objective scientific and reasonable performance management evaluation system, which is suitable for enterprise performance evaluation of supply and demand coordination of agile supply chain, and further set up a specific quantitative measurement and calculation method for indexes in the system.

Through the empirical study on the performance management of power equipment manufacturing industry, Qu Sheng'en (2006) put forward that the degree of excellent performance can be in the following order: customer satisfaction, price elasticity, supplier performance, cost and profit. At the same time, he used the improved balanced Scorecard to establish the performance evaluation system model for the enterprise's finance, customer, internal business process and learning growth, and verified the practicability and effectiveness of the improved balanced scorecard in enterprise performance management evaluation. Through the empirical research on the performance evaluation system of iron and steel logistics service, Han Xinping (2008) put forward the basic principles of constructing logistics service system and the strategy of improving logistics service in iron and steel logistics enterprises, and gave the corresponding analysis and research on the selection and setting of performance indexes in the system.

Taking into account that service security (LIU W H, XIE D, 2013) and fairness LIU W H, XIE D, 2008) jointly influence the selection of functional logistics service providers, LIU W H, SHEN X R, Xie D et al. (2017), on the basis of the uncertainty of service quality, security and fairness, constructed a mathematical model to optimize the number of functional logistics service providers, which are based on the uncertainty, security, fairness and other factors of service quality.

As shown in Table 2.1:

Table 2.1 Contents of Logistics Service Effect Evaluation

No.	Proposer	Main point of view
1	PRTM, the authoritative organization of supply chain management research (2003)	The satisfaction of enterprise order and delivery, the flexibility of production and manufacturing, the rapid response time of the whole supply chain, the management cost of enterprise logistics activities, the production efficiency of all kinds of added value, the turnover days of enterprise cash flow, the inventory cycle of enterprise supply turnover and the turnover rate of enterprise assets.
2	B.M.Beamon（1999）	resource, flexibility, output
3	Brewer and Speh（2000）	(1) the goal of enterprise supply chain management, (2) the actual interests of the final customers, (3) the overall financial interests of the enterprise, and (4) the medium-and long-term development of enterprise supply chain management.
4	J.D.Camm and T.E. Chorman（1997）	(1) enterprise just-in-time transportation rate, (2) enterprise just-in-time delivery rate, (3) accuracy and traceability of enterprise transportation process, (4) completion rate of customer orders, (5) completion rate of enterprise project activities, (6) accuracy of enterprise inventory, (7) damage rate of goods
5	Gunasekaram（2001）	From the aspects of supply chain cooperation and relationship, order execution plan, production and manufacturing level, enterprise logistics and distribution, long-term customer service and satisfaction, accounting and financial management, etc.
6	MA Shihua（2000）	Manufacturing and product quality, upstream and downstream customer service and satisfaction, enterprise asset management and total operating cost
7	XU Xianhao et al.（2000）	The index of enterprise production and marketing rate, the absolute deviation index of enterprise average production and marketing, the ratio of enterprise output to demand, the cycle index of product production in the whole supply chain, the quality index of products in the whole supply chain, the cost index of the core products of the whole supply chain, the overall operating cost index of the whole supply chain.
8	MA Shihua（2002）	To ensure the steady growth of the performance of the whole supply chain
9	CHEN Zhixiang（2004）	Focus on the four areas of information, logistics, capital flow and work coordination in the coordination of supply and demand between enterprises.
10	QU Shengen（2006）	Customer satisfaction, flexibility, supplier performance, cost and profit
11	HAN Xinping（2008）	The Strategy of Logistics Service in Iron and Steel Logistics Enterprises
12	LIU W H,XIE D(2013); LIU W	The uncertainty, guarantee and fairness of service quality.

	H,XIE D(2008) ;LIU W H, SHEN X R, XIE D(2017)	

2.1.2 In-depth Analysis of the Emphasis and Methods of Evaluation

Sengupta et al. (2006), according to supply chain strategy, analyzed the operation of logistics enterprises and production enterprises, evaluated their financial performance level, and compared the two industries to get their similarities and differences.

Anderssona et al. (2002) analyzed whether there were factors that affected logistics procurement according to the logistics procurement link, and held the view that logistics service integrators take customers as the main body to provide them with comprehensive and high-quality services. Mentzer and Myers (2004) subdivided customer groups according to logistics service quality theory, and coordinated customer satisfaction and improved logistics service quality according to cultural differences or organizational structure. Song Zhigang (2016) also believed that there was a need to provide customers with more value-added services through the analysis of customer needs to create greater value, and make profits in logistics service activity to achieve win-win results. Zhou Shiping (2014) constructed the index system of logistics service providers from three aspects: logistics service quality, customer relationship maintenance, and service income and investment. Wei Yu et al. (2017) pointed out that factors affecting the core competitiveness of logistics service providers were analyzed by studying the generation and composition of logistics service customer value. Qiu Li (2016) pointed out that communication was an important way to exchange and obtain information between businesses and customers in the era of service economy, and high-quality response quality in the logistics distribution system can effectively eliminate communication barriers between businesses and customers, enhance trust and satisfaction between each other, and then enhance customers' attitude loyalty and behavior loyalty to the enterprise. Liu Shuo and Li Baozhu (2018) divided the pre-limiting factors that directly affect consumers' perceived logistics service quality into personalized information service quality, logistics support center service quality, logistics process service quality and service error recovery quality, constructed a scientific and systematic basic research

framework and norms, and analyzed the existing platform by using Analytic Hierarchy Process (AHP) and fuzzy evaluation method. Zhang Li and Liang Kai (2018) put forward the evaluation index system of core competitiveness of logistics service providers from three aspects: logistics service quality, customer relationship maintenance, service income and investment, and constructed the evaluation method of core competitiveness of logistics service providers based on ANP-TOPSIS method.

Huang Zuqing et al. (2013) from the perspective of stakeholder theory, constructed a logistics service supply chain performance evaluation system, which includes micro level (functional logistics service providers, integrators and logistics service consumers) and macro level (government, community and residents).

Guo Mei and Zhu Jinfu (2007) proposed a performance evaluation method of logistics service supply chain based on fuzzy rough set. According to the dynamic state of logistics service supply chain, Chen Hu (2012) designed an improved QFD model and used fuzzy evaluation method to evaluate the performance of logistics service supply chain in different historical periods. Ni Lin et al. (2011) put forward the performance evaluation method of logistics service supply chain based on grey AHP. Liu Weihua et al (2011) established a comprehensive performance evaluation index system of logistics service supply chain based on the analysis of logistics service supply chain coordination and service characteristics, which was verified by Analytic Hierarchy Process (AHP) model.

Fan Yuqing (2018) constructed the evaluation index system of the integration level of iron and steel logistics resources. On the basis of five aspects: the integration level of iron and steel logistics infrastructure resources, the integration level of iron and steel logistics organization resources, the integration level of iron and steel logistics information resources, the service level of iron and steel logistics and the income level of iron and steel logistics, the evaluation index system of the integration level of iron and steel logistics resources is constructed, and the fuzzy comprehensive evaluation model is used to verify the feasibility of the evaluation system.

Logistics service quality evaluation models also include HIS-TOQUAL model (FROCHOT I et al, 2000), SITEQUAL model (YOO B and DONTHU N, 2001), LibQUAL model (COOK C et al, 2001), SERVPERVAL model (PETRICK J F 2002) and ES-QUAL model (PARASURAMAN A et al, 2005). However, SERVQUAL model is still one of the most extensive and commonly used models and tools to measure logistics service quality in the service industry.

The specific methods for evaluating the effectiveness of logistics services can be summarized as shown in Table 2.2.

Table 2.2 Methods for Evaluating the Effectiveness of Logistics Services

No.	Proposer	Main point of view
1	Sengupta et al(2006)	Comparison method: logistics enterprises, production enterprises
2	Anderssona et al(2002)	The method of logistics integration
3	Mentzer and Myers(2004)	Logistics service quality theory
4	SONG Zhigang(2016)	The method of value-added service
5	ZHOU Shiping(2014)	From the perspective of logistics service providers
6	WEI Yu et al(2017)	Factors affecting the Core Competitiveness of Logistics Service providers
7	QIU Li(2016)	Remove communication barriers between merchants and customers and enhance trust
8	LIU Shuo, LI Baozhu(2018)	Analytic hierarchy process and fuzzy evaluation method
9	Zhang Li, Liang Kai(2018)	Evaluation method of Core Competitiveness of Logistics Service providers based on ANP-TOPSIS method
10	HUANG Zuqin et al(2013)	From the perspective of stakeholder theory, including the micro level (functional logistics service providers, integrators and logistics service consumers) and the macro level (government, community and their residents)
11	GUO Mei and ZHU Jinfu（2007）	Performance Evaluation method of Logistics Service supply chain based on Fuzzy rough set
12	CHEN Hu(2012)	Improved QFD model
13	NI Lin et al(2011)	Grey AHP method
14	LIU Weihua et al(2011)	ANP Model of Network Analytic hierarchy process
15	FAN Yuiqing(2018)	Integration level of iron and steel logistics resources
16	FROCHOT I et al(2000)	HIS-TOQUAL model
17	YOO B and DONTHU N，2001	SITEQUAL model
18	COOK C et al(2001)	LibQUAL model
19	PETRICK J F(2002)	SERVPERVAL model

20	PARASURAMAN A et al(2005)	ES-QUAL model

At present, the research on logistics service supply chain structure, logistics service supply chain coordination and performance management focused on theoretical research while lacking empirical research. The existing methods to evaluate logistics performance in enterprises include Analytic Hierarchy Process (AHP), DEA method, fuzzy comprehensive evaluation method, efficiency coefficient method, and comprehensive utility method. To a certain extent, managers need to have more mathematical knowledge, and construction of the evaluation system model is relatively complex, so it is difficult for practical managers to understand and operate. At the same time, most of the research on performance management evaluation methods focuses on basic theoretical research, which is less combined with practical enterprises and increases the difficulty of understanding and mastering. Therefore, in the research of logistics performance management evaluation methods of enterprises, it is best to carry out specific empirical research combined with actual logistics enterprises, and elaborate the ideas, modeling process and implementation process in the whole set of evaluation system in order to increase enterprises' perceptual and rational understanding of logistics performance management evaluation.

At the same time, the research and discussion on the performance management of iron and steel logistics enterprises is still limited. When drawing lessons from the advanced theories and practical cases of performance management at home and abroad, and combining practical problems of domestic iron and steel logistics enterprises, this thesis puts forward a set of performance management scheme which is suitable for iron and steel logistics enterprises to provide useful reference for more enterprises in the industry.

2.2 Influencing Factors and Optimization Model of Iron and Steel Logistics Services

(1) Influencing Factors of Iron and Steel Logistics Service

Wang Li (2013) analyzed the current situation of the domestic iron and steel industry and steel trading enterprises and the advantages and external conditions of

China Railway Materials Co., Ltd, and introduced the development strategies of the company, such as strengthening the integration of resources, thus giving full play to its own advantages and improving the service capacity of the upper reaches of the iron and steel supply chain. Andrew Potter et al. (2004) took the United Kingdom as an example to study the gradual evolution of the British iron and steel supply chain from the traditional to the integrated supply chain from 1990 to 2001, emphasizing the restrictive role of the organizational boundary.

Ma Shengming and Shen Wenji (2019) took Jiulong Iron and Steel Logistics Park as an example to construct a complete business model innovation approach for logistics enterprises from four aspects: innovation point, innovation line, innovation aspect and innovation body.

Liu Yanhu (2020) pointed out that the epidemic situation of COVID-19 had little impact on the railway transportation of external logistics transport of iron and steel enterprises in China, moderate impact on waterway transport, greater impact on road transportation, less impact on the purchasing end, and greater impact on the sales end. Affected by the epidemic, the external logistics transport costs of iron and steel enterprises fluctuated slightly.

Zhao Jufeng (2021) believes that under the general environment, the logistics business of the iron and steel industry has also entered the digital age of information and networking. Compared with other industries, the modern logistics industry depends more on the transmission, processing, storage and integration of information.

(2) Optimization Model of Iron and Steel Logistics Service

Wang Yunfang (2009) analyzed the problem of supplier management in iron and steel enterprises, put forward the method of establishing strategic partner in supply chain, expounded the production management of iron and steel enterprises, put forward the method of optimizing production relations in iron and steel enterprises, analyzed the sales and logistics methods of iron and steel enterprises, and put forward the method of processing and distribution to stabilize the supply chain. Aiming at the problem of sales logistics at the end of the supply chain of iron and steel enterprises and the distribution characteristics of iron and steel enterprises, Zhao Xin (2005) analyzed and selected the distribution mode suitable for iron and steel enterprises from the general distribution network model and established the mathematical programming model of two-level distribution network. Yin Renjie (2011), aiming at the iron and steel supply chain, studied the brittleness of the complex system, found

out the brittleness factor and established the corresponding supply chain brittleness risk system. After further research, he made reasonable assumptions and constructed the brittleness model of complex system aiming at the field of iron and steel supply chain. Jia Rui (2011) studied the agility of iron and steel logistics service supply chain from the perspective of logistics service integration under Supply-Hub mode, and analyzed the resource integration and optimization of iron and steel logistics service supply chain. M. H. Fazel Zarandi and R. Gamasaee (2013), in order to reduce the bullwhip effect in the supply chain, proposed a new method of demand forecasting, that is, a fuzzy system model, and applied it in iron and steel production.

Xiaohuan Wang et al. (2013) proposed a method of supply chain decision support based on ontology and verified the feasibility and effectiveness of this method through an example of China's iron and steel industry. Briano, Enric et al. (2010) sought an effective way to deliver steel products to customers, constructed three different transportation networks, and designed the iron and steel supply chain through appropriate models and simulation software. In addition, Xiong Feng et al. (2012) proposed to establish a cloud business platform through the combination of cloud computing and e-commerce to form the whole process sharing of business services in the iron and steel industry chain, which was verified by the application in the enterprise. Jin Yuran (2012) proposed a revenue distribution model of iron and steel logistics alliance based on Raiffa solution, which verified that this method can motivate partners and improve the service level of iron and steel logistics. Liu Yanhu and Zhang Yong (2014) introduced the significance of logistics in finding new profit growth points for iron and steel enterprises, then explained the composition of logistics system optimization in iron and steel enterprises from four aspects: transportation system, loading and unloading system, warehousing system, and cost index and control. Finally, they used an actual case to introduce in detail how to apply modern logistics technology to the optimization design of logistics system in iron and steel enterprises, and analyzed the optimization effect.

Yuan Yuan (2017) proposed a hybrid algorithm of spatio-temporal network modeling, convex relaxation, Lagrangian relaxation and convex optimization for production scheduling problems such as mixed flow shop scheduling, slab and contract allocation considering logistics cost, and slab and contract robust reallocation. With the aim of the logistics scheduling problems such as crane scheduling and iron and steel product transfer scheduling in steel coil reservoir area, the hybrid algorithms

of spatio-temporal network modeling, approximate dynamic programming, Lagrangian decomposition and convex optimization are proposed respectively. Song Zhilan et al. (2019) used EIQ-ABC analysis method to analyze the outgoing data of M company's steel logistics park from IQ and IK to understand the weight of all kinds of steel in the logistics park and to get the ABC classification results, and optimize the storage location of M company's steel logistics park according to analysis results.

Liang Shuang and Cai Peng (2020) analyzed the data generated by the information platform and extracted valuable features, and then proposed a combination model based on long-term and short-term memory network (LSTM) and linear model (Linear) to predict truck waiting time. Chen Cheng et al. (2020) first find out the characteristics of the quantity and frequency of goods shipped through the EIQ analysis of historical order data, then classify the goods according to ABC, and make clear the layout requirements of each type of goods in and out of the warehouse. Secondly, the level of close relationship between goods is obtained by using SLP method, and the relative location and layout requirements of goods are determined. Liu Tung Kung et al. (2021) constructed the by-product transportation and logistics model of iron and steel plant through in-plant route information, vehicle route systematization and a consideration of the frequency of transport demand. The improved variable Length Chromosome Ending Technique and Bi-level Genetic Algorithm are used to effectively solve the problem of different partition transportation in the application of double-layer genetic algorithm.

This thesis will be based on the above literature, combined with the actual situation of BJ company, and finally complete the construction of the evaluation index system.

2.3 Iron and Steel Logistics Service Evaluation

Lu Xin and Bai Hao (2012) established the long-process carbon emission model of iron and steel enterprises and found that the ecological regionalization of iron and steel production, optimized energy structure and strengthened energy conversion function of iron and steel production play a significant role in carbon emission reduction.

Zheng Linlin (2014) used the improved balanced scorecard model to improve the non-financial indexes on the basis of financial indexes obtained by the

two-dimensional activity-based costing method. A set of logistics system performance evaluation index system including economy, logistics process, logistics system development capability and logistics service quality was constructed to help iron and steel enterprises monitor logistics management in real time.

Zou Anquan, Liu Junhong and Luo Xingling (2015) constructed a dynamic model of carbon emission system in iron and steel supply chain on the basis of in-depth analysis of the causality of carbon emission system in iron and steel supply chain, and simulated the effects of carbon emissions per ton steel production, unit purchasing carbon emissions and purchasing cycle on the total carbon emissions in iron and steel supply chain. It is found that the total carbon emissions of the supply chain increases with the addition of carbon emissions per ton steel production and unit procurement, while the procurement cycle has a certain impact on the total carbon emissions of the supply chain, but the effect is not obvious. Finally, carbon emission control suggestions were put forward from three aspects: introducing relevant technology and equipment to reduce carbon emissions per ton steel production, optimizing logistics process to reduce unit procurement carbon emissions, and reasonably arranging procurement cycle to optimize inventory.

Li Siying, Chen Yinghua, Luo Xingling (2016) combined the current situation of high energy consumption and high emissions in the iron and steel industry, designed a kind of steel product life cycle process, including target layer, strategy layer, life cycle layer, support layer altogether four-layer structure of iron and steel supply chain carbon emission control model. The four main indexes of carbon emission, time, cost and process technology were selected as the decision-making objectives of the evaluation model of carbon emission control mode in iron and steel supply chain, and the hierarchical evaluation structure model of carbon emission control mode in iron and steel supply chain was established. The application effect of carbon emission control mode in supply chain of Xiangtan Iron and Steel Co., Ltd. is evaluated, and the relevant control strategies are put forward.

Ma Guihua et al. (2018), based on the cross-sectional data of China's major iron and steel logistics enterprises in 2018, selected three first-level indexes and nine second-level indexes. Firstly, principal component analysis was used to comprehensively evaluate the logistics efficiency of iron and steel logistics enterprises. Secondly, the comprehensive scores of logistics efficiency were systematically clustered, and then the heterogeneity of relevant indexes of each type of iron and steel

logistics enterprises was analyzed, and the key indexes affecting logistics efficiency were obtained. Finally, reasonable suggestions were put forward to improve the logistics efficiency of China's iron and steel logistics enterprises.

Yao Luyi (2018) put forward the more prominent problems in the iron and steel logistics network at the present stage, such as the degree of specialization of employees, relevant policies directly affect the efficiency of logistics and transportation, and then explore the relevant management measures.

Wu Wei et al. (2020) pointed out that iron and steel logistics enterprises have sufficient resources, and they should make full use of these resources to expand their business, explore new profit growth points, and help steel logistics enterprises explore the automotive after-market and one-stop platform.

2.4 Logistics Service Supply Chain

With the increasingly fierce market competition and the diversification of consumer demand, traditional manufacturing enterprises pay more attention to the impact of service on the competitiveness of enterprises. Many manufacturing enterprises gradually expand the meaning of products from simple tangible products to product-based value-added services, the trend of which is called product service. Logistics service supply chain management is to use the ideas and methods of management, with a logistics service unit as the core, to quickly integrate all kinds of logistics resources to meet the needs of users by integrating the superior resources of partners in the service supply chain, and the ultimate goal is to improve the level of logistics services, reduce the total cost of services, and achieve greater benefits and stronger competitiveness. Logistics service supply chain is a professional concept gradually formed by applying the relevant theories of service supply chain to the logistics industry on the basis of the development of service supply chain. It is a new type of supply chain with logistics service integrators as the core, relying on advanced information technology to integrate logistics service resources, providing personalized and networked logistics services for logistics demanders and providing logistics services for manufacturing supply chains.

2.4.1 The Connotation of Logistics Service Supply Chain

(1) The Definition of Logistics Service Supply Chain

The theory with high recognition is that the logistics service supply chain is a

network chain structure which takes the logistics service integrator as the core member and combines the logistics service supplier and the demand side. Many domestic scholars have also defined the logistics service supply chain. For example, Yan Xiuxia (2005) defined the logistics service supply chain as the process of the core enterprise around logistics services applying modern information management technology and controlling information flow, logistics and capital flow in the supply chain to realize service value-added and user value. It can be understood that the transportation, warehousing, distribution and other functions of logistics form a network structure with logistics end users. Shen Chenglin et al. (2005) defined the logistics service chain as a new supply chain with integrated logistics service enterprises as the core in order to provide a full range of high-quality logistics services for the logistics demand side. Gao Zhijun et al (2009) pointed out that the logistics service supply chain is a functional network chain structure model which is composed of logistics service integrators who integrate various logistics capabilities as the core enterprise, with customer logistics service demand as the driving force, through the signing of contracts between the various node enterprises in the supply chain to effectively control the service flow, capital flow and information flow and to integrate all kinds of logistics resources on the chain to realize the comprehensive integration of service process management, service capability management, service value management and service performance management, which is from a single logistics service subcontractor to the logistics service demand side. On the basis of the above definition, Cui Aiping, Liu Wei and Zhang Xu (2008) further elaborated the logistics service supply chain as follows: logistics service supply chain refers to the core enterprises of logistics services, starting from the needs of customer logistics services, through the control of logistics, service flow, capital flow and information flow, to integrate all logistics resources on the chain, and integrate service process management, service capability management, customer value management and service performance management to construct a complete functional network chain structure model of logistics value-added services from logistics subcontractors to logistics demand side.

Generally speaking, the narrow logistics service supply chain can be understood as the supply and demand cooperation structure of the network chain from the upstream functional logistics enterprises to the integrated logistics service providers to the end customers in order to provide integrated integrated logistics services; while

the logistics service supply chain in a broad sense can be extended to the upstream providers of logistics facilities, equipment and information technology, and includes the cooperation structure composed of all enterprises or departments that cooperate with each other in order to realize the demand of integrated logistics services.

(2) Characteristics of Logistics Service Supply Chain

Logistics service supply chain is formed with the development of logistics service industry. The continuous growth of service outsourcing and product service and the rapid development of related services have laid a solid foundation for the emergence and development of service supply chain. This model connects the logistics operations on the chain, such as transportation, storage, packaging, procurement, circulation, processing and distribution with logistics end users to form a whole functional network chain. In the process of collaborative cooperation and competition, the alliance logistics service enterprises on the chain show obvious industry characteristics by information sharing, risk sharing, common decision-making, common development and mutual benefit. Based on the analysis of Cui Aiping (2008) and Zhang Dehai (2007), this thesis summarizes the characteristics of logistics service supply chain as follows.

First, the complexity of the system.

Logistics service supply chain system is a complex network composed of participants and multiple nodes, such as logistics service subcontractors, logistics service integrators and logistics service demanders, and it is difficult to coordinate among members. At the same time, the service supply chain, as a component of the supply chain, has a certain intersection with the product supply chain. Each enterprise and each department of the enterprise have different functions but are related to each other. Information flow, capital flow, business flow and other elements interact with each other in the same system. In addition, the logistics service supply chain system is the product of change of the business environment, and changes of economy and politics, including the natural environment, will promote the dynamic development of the system itself, so the logistics service supply chain has a high degree of complexity and instability.

Second, strong information processing ability.

Because of the extensiveness and heterogeneity of logistics demand, when logistics service integrators design business processes and purchase, produce and sell according to the needs of consumers, design and choose the best operation plan, it is

necessary to process and classify the customer's information such as transfer, warehousing and distribution, coupled with the different geographical location of the customer and the complexity of the logistics network formed by various service elements. The logistics service supply chain system must have strong information processing ability and operate smoothly when members of the logistics service supply chain share information in real time. Rapid information processing technology is the core competence of integrated logistics service providers, which highlights the typical advantages of logistics service supply chain, and is also the fundamental difference between logistics service integrators and traditional functional logistics enterprises.

Third, the guarantee of service capacity.

Logistics service is a kind of service product which has five dimensions: reliability, security, responsiveness, empathy and invisibility. Among them, reliability refers to the ability to perform promised service accurately and reliably, which is one of the most important determinants of customer perceived service quality. As it is a complex network chain structure composed of enterprises that undertake many logistics functions, it is necessary to integrate intangible logistics management knowledge and tangible logistics facilities and equipment in the supply chain to provide timely, reliable and satisfactory integrated logistics services to logistics customers, which will affect whether the whole supply chain can survive and develop in the increasingly competitive logistics service market and whether it can gain competitive advantage.

Fourth, it is highly complementary.

Logistics service supply chain mainly provides intangible logistics services to customers, and its service capacity is not determined by the level of a subcontractor or integrator, but by the joint action of elements and interest entities. These elements and entities are linked together through complementary relations to achieve the optimization of the overall function of the supply chain. Logistics service integrators with high organizational management ability select appropriate logistics professional subcontractors at an appropriate time to encourage subcontractors to effectively achieve specific logistics service functions; while subcontractors with strong professional capabilities need integrators with higher organizational and management capabilities to integrate and coordinate and cooperate to provide satisfactory logistics services to customers. Therefore, the relationship between the integrator and the main subcontractor is a strategic complementary partnership of risk-sharing and

benefit-sharing, which is highly complementary.

Fifth, the system is highly integrated.

Logistics service supply chain, applying integrated management ideas and methods, circles around a certain logistics service demand to integrate rapidly all member enterprises in the chain of personnel, processes and technology and other superior logistics resources to meet customer needs. For the same service product, it implements the integration of service standardization, business standardization and management to form a seamless operation whole. The services it provides include not only transportation, warehousing and distribution services, but also report management, information management, business consultation, carrier selection, freight forwarder, customs declaration, product repackaging, inventory replenishment, and labeling.

The connotation of logistics service supply chain can be summarized as shown in Table 2.3:

Table 2.3 Connotation of Logistics Service Supply Chain

Item	Proposer	Specific point of view
Definition of logistics service supply chain	Yan Xiuxia et al. (2005)	Combine the transportation, warehousing, distribution and other functions of logistics with the logistics end-users to form a network structure.
	Shen Chenglin et al. (2005)	A new type of supply chain with integrated logistics service enterprises as the core to provide a full range of high-quality logistics services for the logistics demand side.
	Gao Zhijun et al. (2009)	A functional network chain structure model from a single logistics service subcontractor to a logistics service demander.
	Cui Aiping, Liu Wei and Zhang Xu (2008)	Logistics service supply chain refers to the integration of all logistics resources around the core enterprises of logistics services, starting from the needs of customers' logistics services, through the control of logistics, service flow, capital flow and information flow. integrate service process management, service capability management, customer value management and service

		performance management to build a complete functional network chain structure model of logistics value-added services from logistics subcontractors to logistics demanders.
Characteristics of logistics service supply chain	Cui Aiping, Liu Wei and Zhang Xu (2008)	● The complexity of the system. ● Strong information processing ability. ● The guarantee of service ability. ● They are highly complementary to each other. ● Highly integrated system

2.4.2 Reasons for Formation of Logistics Service Supply Chain

Since Drucker proposed that logistics is the dark continent of the economic field in Fortune magazine in 1962, the concept of logistics has been sublimated and logistics integration has been gradually extended to supply chain integration. Supply chain management emphasizes the core competitiveness of enterprises, the core members of the supply chain are manufacturing enterprises or retailers, and their core competitiveness is not in logistics. Therefore, in order to improve the efficiency of the main business and reduce the cost of other resources, enterprises need to outsource their own logistics business, which provides opportunities for the emergence of logistics services (Gao Zhijun, Liu Wei, and Wang Yuefeng, 2009). The rapid development of logistics outsourcing service and logistics service industry has laid a solid foundation for the emergence of logistics service supply chain. To sum up, the formation of logistics service supply chain comes from the following reasons.

(1) The Development of Specialization and Inevitable Outcome of Social Division of Labor

With the deepening of the social division of labor, the more single the function of the enterprise is, the higher the degree of specialization of production and management is. After the enterprise has experienced the development of the management mode from vertical integration to horizontal integration, logistics has been stripped from the internal functional departments of the enterprise, gradually realizing logistics service outsourcing, and further developing into the logistics service supply chain. Logistics presents a state of networking, specialization and independence, which is not only the result of the deepening of social division of labor, but also the inevitable outcome of the development of social division of labor and

specialization (Cui Aiping, 2008). Li Chenyang et al. (2021) considered the incentives of logistics service integrators to logistics service providers from the quantity of orders, the reduction of logistics costs and the quality of logistics services, analyzed the reasons for the weakening of the incentive effect, and improved the relevant incentive theory. Luo Ying et al. (2021) discussed the design of equity cooperation mechanism in the supply chain of shared logistics services. When supply chain members choose to cooperate in revenue-sharing or cost-sharing mechanism, not all the cooperation scenarios considered in the research can improve the total profit of the supply chain, but at least one situation can achieve the improvement of Pareto.

(2) Strengthen the Core Competitiveness of Service Chain Channels

For the main participating enterprises in the logistics service supply chain, they must achieve a high degree of cooperation, information sharing and risk sharing, so that logistics service providers can jointly plan the optimal method and adopt more effective means to meet the needs of users, making logistics services achieve economies of scale and synergy and continuously improve logistics efficiency and reduce logistics costs, which are the internal driving force and important reasons for the formation of logistics service supply chain (Yan Xiuxia et al. 2005). At the same time, the formation of the logistics service chain eliminates the waste of resources and repeated efforts. Especially for the traditional functional logistics companies, in order to meet the comprehensive logistics needs of users, they invest a lot of manpower, material resources and capital, thus greatly increasing the investment risk of the enterprise.

(3) Reduce the Transaction Cost of Both Supply and Demand

Traditional functional logistics service providers are limited to their own capabilities, so it is difficult to organize large-scale logistics activities, but through strategic cooperation with logistics service integrators to form a logistics service supply chain, functional logistics service providers enter the market alone to reduce the cost of collecting, sorting and processing market information, as well as the cost of negotiating, signing and supervising implementation. Through cooperation with logistics service integrators, the business volume of functional service providers has increased, the utilization rate of resources has been improved, and the goal of connotative expanded reproduction and steady improvement of profit margins of

logistics enterprises has been achieved (Liu Yuying, 2009). The formation of the logistics service supply chain greatly reduces the logistics operation cost, thus reducing the cost of both sides of the logistics transaction. Luo Ying et al. (2021) discussed the design of equity cooperation mechanism in the supply chain of shared logistics services. When supply chain members choose to cooperate in revenue-sharing or cost-sharing mechanism, not all the cooperation scenarios considered in the research can improve the total profit of the supply chain, but at least one situation can achieve the improvement of Pareto. Aiming at the problem of inter-agent coordination of logistics network, Mou Guangyu (2021) studied the three-level supply chain composed of subcontractors, logistics integrators and cross-border e-commerce enterprises. Combined with cost-sharing coefficient and income-sharing coefficient, a combined contract coordination model is established and solved by competitive alliance method.

(4) Meet the Changing Needs of Business Operation Environment

Since the 1990s, the growth of the global market and the increase of foreign procurement have increased the demand for logistics functions. Business globalization is considered to be the core driving force of logistics outsourcing. With the further development of logistics services, industrial and commercial enterprises' logistics outsourcing business is also increasing, resulting in an increase in the type and quantity of logistics demand. Only by forming a professional logistics service supply chain management can enterprises meet the changing needs of market environment and achieve their sustainable development. For example, Guo Ying (2021) focused on the vertical integration in the logistics service supply chain, considering the supply chain system composed of one logistics service integrator and two logistics service providers. Based on the logistics service quality cost, this thesis constructs the quality game model under the vertical dispersion and vertical integration mode respectively, discusses the influence of the vertical integration strategy on the operation efficiency of the logistics service supply chain, and analyzes the market conditions of the vertical integration strategy. The research shows that the intensity of competition is the key factor that affects the decision-making and strategy choice of enterprises, and the vertical integration will have a synergistic effect on the integrated logistics service providers and an external effect on the unintegrated logistics service providers. Only when the intensity of competition is strong, logistics service integrators and logistics

service providers will choose vertical integration at the same time, which will not only help to improve the overall level of logistics service quality, but also reduce the cost of realizing logistics service quality.

(5) Make Up for the Lack of Capacity of a Single Logistics Enterprise

With the development of social economy and diversified demand for materials, product ordering is gradually developing in the direction of small batch customization, which promotes the diversity of logistics demand. Most of the existing logistics enterprises are upgraded from the original transportation enterprises or warehousing enterprises. The operation capacity and logistics functions of logistics enterprises are in shortage, coupled with the lack of capital investment, the current situation of a single logistics enterprise cannot meet the development needs of manufacturing enterprises. Only when functional logistics providers transfer the corresponding logistics functions to logistics can enterprises finally meet the needs of consumers. For example, Wang Dongsheng and Zheng Kuanming (2020) pointed out that there is a significant positive relationship between logistics service supply chain integration and logistics performance; the higher the degree of information sharing, the more it can promote the coordination of logistics enterprises; the more stable the cooperative relationship is, the more it can promote the coordination of logistics enterprises; the more stable the cooperative relationship is, the higher the degree of information sharing among logistics enterprises is; the function of information sharing plays an intermediary role between the cooperative relationship and coordination mechanism of logistics enterprises. Zhang Fang and Wang Pengcheng (2021) pointed out that there is a complex causal relationship between Logistics Service Supply Chain(LSSC) systems, which often plunging LSSC member enterprises into trouble in decision-making. In order to solve the difficult decision-making problem of LSSC member enterprises, this research, on the basis of analyzing the influencing factors of LSSC, constructs the LSSC system dynamics model in consideration of supplier risk preference with the help of system dynamics method, and simulates the logistics service capability holding quantity and supplier service backlog order quantity in its main link variables. The results show that the logistics service capability holdings and supplier service backlog of LSSC members are affected by suppliers' risk preference; combined with the risk perception source analysis, it is found that adjusting the risk perception source parameters can optimize the backlog of supplier service orders and

solve the problems of information asymmetry and bullwhip effect in LSSC to some extent.

(6) Technology and Policy Environmental Logistics Specialization Provides a Reliable Guarantee

The rapid development of manufacturing equipment industry and modern information technology has also played a catalytic role in the reform of the management mode of logistics enterprises. Enterprise management is inseparable from effective information technology support, and logistics efficiency cannot be improved without advanced logistics technology and equipment. The construction of logistics information platform and the use of various professional logistics information technology has prepared favorable market conditions for logistics enterprises to change the new management mode (Liu Yuying, 2009). At the same time, in order to promote the joint development of logistics industry, manufacturing industry and trade circulation industry, the government has also issued relevant policies for the development of the logistics industry. In 2005, the *National Standard for Classification and Evaluation Index of Logistics Enterprises* (GB/T19680.2005) classified logistics enterprises into transport logistics enterprises, warehouse logistics enterprises and comprehensive logistics enterprises, and issued corresponding preferential policies such as taxation and credit, which are conducive to the healthy and sustainable development of logistics industry and provide a strong impetus for the innovation of the management mode of logistics enterprises. Liu Weihua et al. (2021) discussed the original practice and application of smart supply system (SSS) and intelligent logistics service (ILSs).

The reasons for the formation of logistics service supply chain can be summarized as shown in Table 1.4.

Table 1.4 Reasons for the Formation of Logistics Service Supply Chain

Reason	Supporter	Main point of view
1. The inevitable outcome of professional development and social division of labor.	Cui Aiping(2008)	Logistics is stripped from the internal functional departments of the enterprise, and logistics service outsourcing is gradually realized.
	Li Chenyang et al. (2021)	The incentive of Logistics Service Integrator to Logistics Service provider
	Luo Ying et	When supply chain members choose to cooperate on

	al.(2021)	revenue sharing or cost sharing mechanism, not all the cooperation scenarios considered in the study can improve the total profit of the supply chain, but there is at least one situation that can achieve the improvement of Pareto.
2. Strengthen the core competitiveness of service chain channels.	Yan Xiuxia et al. (2005)	Logistics services achieve economies of scale and synergy, constantly improve logistics efficiency and reduce logistics costs.
3. Reduce the transaction cost of both supply and demand.	Liu Yuying(2009)	Through cooperation with logistics service integrators, the business volume of functional service providers has increased, the utilization rate of resources has been improved, and the goal of connotative expansion and reproduction of logistics enterprises and steady improvement of profit margins have been achieved.
	Luo Ying et al.(2021)	When supply chain members choose to cooperate in revenue-sharing or cost-sharing mechanism, not all the cooperation scenarios considered in the study can improve the total profit of the supply chain, but at least one situation can achieve the improvement of Pareto.
	Mou Guangyu(2021)	Aiming at the problem of inter-agent coordination in logistics network, on the basis of three-level supply chain composed of subcontractors, logistics integrators and cross-border e-commerce enterprises, a combined contract coordination model is established by combining cost-sharing coefficient and revenue-sharing coefficient, and solved by competitive alliance method.
4. To meet the changing needs of the business operation environment.	GUO Ying et al.(2021)	The intensity of competition is the key factor that affects the decision-making and strategy choice of enterprises; vertical integration will have a synergistic effect on logistics service providers who accept integration, while it will have external effects on logistics service providers that have not been integrated. When and only when the intensity of competition is strong, logistics service

		integrators and logistics service providers will choose vertical integration at the same time, which will not only help to improve the overall level of logistics service quality, but also reduce the cost of realizing logistics service quality.
5. The need to make up for the lack of capacity of a single logistics enterprise.	Wang Dongsheng and Zheng Kuanming(2020)	There is a significant positive relationship between logistics service supply chain integration and logistics performance; the higher the degree of information sharing is, the more it can promote the coordination of logistics enterprises; the more stable the cooperative relationship is, the more stable the cooperative relationship is. the higher the degree of information sharing among logistics enterprises; the information sharing function plays an intermediary role between the cooperative relationship and coordination mechanism of logistics enterprises.
	Zhang Fang and Wang Pengcheng (2021)	The logistics service capability holdings and supplier service backlog of LSSC members will be affected by suppliers' risk preference. Combined with the risk perception source analysis, it is found that adjusting the risk perception source parameters can optimize the backlog of supplier service orders and solve the problems of information asymmetry and bullwhip effect in LSSC to some extent.
6. Technology and policy environment logistics specialization provides a reliable guarantee	Liu Yuying(2009)	The construction of logistics information platform and the use of various professional logistics information technologies prepare favorable market conditions for logistics enterprises to change their new management mode.
	2005 National Standard of Classification and Evaluation Indexes of Logistics	Logistics enterprises are classified as transport logistics enterprises, warehouse logistics enterprises, comprehensive logistics enterprises, and issued the corresponding tax, credit and other preferential policies.

	Enterprises (GB/T19680.2005)	
	Liu Weihua et al.(2021)	The original practice and application of SSS and ILSs are discussed.

2.4.3 Domestic and Foreign Research Status

From the above literature review, it can be found that:

Service science is a new compound cross-discipline, which is the integration of computer science, operation research, industrial engineering, management, economics, sociology, behavioral science, and psychology (edited by Strauss and translated by Wu Jian and Li Deng Shuiguang, 2010). With the development of a new round of scientific and technological revolution represented by information and communication technology, the global service industry is experiencing the core of technology-economic paradigm transformation. The rapid development of Internet, cloud computing, Internet of things, knowledge service and intelligent service is providing powerful tools and supporting environment for service innovation, and the service industry is becoming a high-end and strategic industry to promote economic and social development. Based on this background, logistics service supply chain is born. With the enhancement of complexity and integrity of logistics service outsourcing, logistics service organizations take the market demand as the starting point and form a service process based on the relationship between supply and demand. With the rise of service science and the gradual maturity of supply chain management theory, the research of logistics service supply chain has attracted the attention of academia and enterprises home and abroad. Through literature review, the existing research on logistics service management focused on the structure of service supply chain, the selection of logistics service providers, the establishment of logistics service supply chain coordination mechanism and performance evaluation.

(1) Research on Service Supply Chain

Service supply chain refers to process management, information management, service performance, capability management and fund management (ELLRAM et al., 2004) that occur in professional services from the initial supplier to the end customer. Most scholars believe that this is an early discussion on service management. In developed countries, the research on service supply chain has been paid more and

more attention by academia and business circles, and research results have been achieved. EDWARD et al. (2000) designed a four-level mortgage service supply chain, in which services at all levels are not ready before the customer arrives, and cannot be managed by adjusting inventory like the product supply chain, but can be managed by adjusting service capacity. Many industries, such as insurance, consulting, professional services and medical care have similar process structures. Dirk de Waart et al. (2004) established a service supply chain framework based on organizational decision-making, systems and tools, and performance management; Tuncdan Baltacioglu et al. (2007) considered that service providers are the core enterprises of the service supply chain, and established the IUE-SSC model. HENK et al. (2003) took the telecom industry as an example to study the bullwhip effect in the service supply chain. The results show that root causes and solutions of the bullwhip effect in the service supply chain are different from those in the product supply chain. Although there is a significant difference between the service supply chain and the product supply chain, we can selectively learn from mature theoretical achievements in the product supply chain and apply them to the service supply chain. Edward G. Anderson et al. (2006) studied the process of service customization and supply optimization control model in two-level service supply chain under random state, and found that decentralized control of service supply chain would not degrade its performance under the condition of information sharing. Coyle, Angela (2010) in the process of studying the difference of social relations and cultural background on the efficiency of customer service, clarified that the offshore work of subcontract service contract has a great influence on the promotion of labor relations, and discussed how to avoid the difficulty of labor training. Navonil Mustafee (2009) established a distributed time model and analyzed the blood service supply chain in the UK by distributed simulation. In the aspect of after-sales service supply chain, N. Saccani, P. Johansson, M. Perona (2007) studied the configuration of after-sales service supply chain through several cases. Anderson, Lundeen and Morrice (2006) designed a two-stage linear staff placement model to study the dynamic behavior of customized service supply chain through the actual investigation of the oil service industry. Chou, Ye and Yuan (2006), on the basis of the practice of the world's leading electronic manufacturing service providers and the largest customer enterprises, aimed at the software of the supply chain, applied the case investigation method to analyze the common problems and individual special problems, and summarized the opportunities

and challenges faced in the research of electronic service supply chain. Morrice, Bharadwaj and Anderson (2004), aiming at the management and coordination of two-stage customized service supply chain, used linear control theory to model its decentralization, centralization and information non-sharing, and carried out corresponding regression analysis and simulation.

In China, scholars have done research on the service supply chain. Fu Qiufang et al. (2010) based on the new definition of the concept of service supply chain, established the structure model of service supply chain, analyzed the characteristics of service supply chain, and put forward the first, second and third operation modes of SCOR model and SSCOR model, and at the same time analyzed the service process of service enterprises. Wang Zhenfeng et al. (2009) established a service supply chain management model based on information center. Suppliers, service providers and customers carry out human resource management, capacity management, demand management, order management, relationship management, service management and contact with finance, taxation, banking, industry and commerce and other supply chains through information centers. Song Hua et al. (2008) constructed the overall structure of the service supply chain by comparing and analyzing the differences between manufacturing supply chain and service supply chain, including business process, network structure and management components, using the method of case study to explore the structural model and innovation characteristics of the service supply chain. Gui Shouping et al. (2010) studied the asymmetric information risk relationship model, status and risk problems of stakeholder cooperation in service supply chain, and constructed a risk optimization mathematical model of stakeholder cooperation in service supply chain. Cheng Jiangang et al. (2009) used the multi-objective mixed integer programming model to optimize the service supply chain network, and divided the service supply chain network design problem into two sub-problems: service provider selection and service station location selection. The procurement cost is considered in the service provider selection, and the facility cost and customer flow are considered in the service station location selection. Finally, the model adopts the multi-objective as a single-objective method to solve the problem. Song Danxia (2009) aimed at the background of the rise of service outsourcing and the rapid development of producer services on the basis of the study of the connotation of service supply chain, and put forward the basic model of producer service supply chain based on the perspective of service outsourcing. The

characteristics are discussed from aspects of supply chain structure, operation mode, supply chain stability and supply chain management, and finally, the formation motivation of producer service supply chain from two aspects of external pulling force and internal driving force is put forward.

As for application research of service supply chain in service industry, Jia Qingping et al. (2009) based on the field investigation of a town in Jiangxi Province, analyzed the problems existing in the medical supply chain system of a town hospital in the main enterprise of downstream supply chain, and put forward a series of corresponding policies and measures to optimize the rural medical supply chain. Peng Hongjun et al. (2009) took a large coal enterprise as the research object, studied the integrated decision-making problem of the supply chain, and maximized the total profit and customer satisfaction of the large-scale coal supply chain system. Then, a multi-objective integrated decision-making model of large-scale coal supply chain is established, and the strategy of using goal programming method to solve the multi-objective decision-making model is put forward. Based on the idea of supply chain management, Mao Chaoyan et al. (2008) put forward the concept of leasing service supply chain, analyzed the characteristics of leasing service supply chain and its relationship with closed-loop supply chain and circular economy, and put forward the implementation strategy of leasing service supply chain management. Jin Liyin et al. (2006) established a structural equation model between service supply chain management activities and enterprise performance and customer satisfaction, and made an empirical analysis based on the data of China's civil aviation service industry. The results show that the leadership of service enterprises has a positive effect on the strategic management and operation management of service supply chain, and also has a positive impact on the construction of enterprise service information system. Lin Jiabao et al. (2009) studied the coordination mechanism between mobile operators and content service providers, constructed a two-level supply chain optimization model and analyzed it. Taking Tianjin Transportation Logistics Co., Ltd as an example, Liu Weihua (2008) introduced the main strategies for the design of service supply chain and put forward the integrated design process of service supply chain, which includes five aspects: the design of service products, the demand analysis of the construction of service supply chain, the selection and determination of members of service supply chain, the determination of the type of service supply chain, and the formation and operation of service supply chain. Gou Juanqiong (2009) analyzed the

changing trend of system structure and operation mode in the evolution of supply chain to service system from the perspective of dynamic integration and service-oriented, as well as the characteristics of service-oriented loose integration system in service science. A supply chain network model based on service components is proposed, and the theoretical research and model verification are carried out through the analysis of the supply chain integration model and business model of Liantai Garment Company.

(2) Research on Logistics Service Outsourcing

In recent years, the competitive environment that enterprises are facing is becoming fiercer. In order to improve their core business, most enterprises take the initiative to outsource non-core business such as logistics services to third-party logistics enterprises, which also promotes the related research of logistics service outsourcing. Maltz and Ellram (1997) put forward a total cost calculation method for logistics service outsourcing decision-making, which is based on common production and purchase analysis, and adds cost factors such as customer satisfaction and quality measures. At the same time, they also compare the different decision-making methods of outsourcing logistics services and outsourcing parts. Frallkel, Bolumole and Naslund (2007) pointed out that it was difficult to accurately define the concept of outsourcing for different enterprises, and logistics outsourcing means different businesses and situations. Based on several social science theories, they summarized the relevant factors that affect the decision-making of logistics outsourcing. Hovora (2001) studied the logistics of carry-on goods in air passenger transport, and proposed that airlines outsource this logistics business to improve passenger satisfaction and loyalty. Copacino (1997) believed that 3PL can provide customers with two or more logistics services at the same time, and the ultimate goal was to help customers reduce costs, while the idea of 4PL was to increase the potential full value for the whole customer supply chain, so logistics service outsourcing needed to improve its logistics service capabilities in the aspects of decision support, organization management and logistics information sharing. Zhu, Han and Seah (2002) believed that logistics services played a connecting role in the process of economic globalization. Logistics parks have emerged in Singapore to provide integrated logistics services for the manufacturing industry. Distribution business has been paid attention to, and logistics service outsourcing has accelerated the reconstruction of the manufacturing industry

in Singapore. Sohail, Austin and Rushdi (2003, 2004) investigated the use of 3PL in Ghana and Malaysia from the aspects of logistics service outsourcing contract decision-making process and its influence on the company. The analysis found that logistics service outsourcing has brought benefits to most companies. Anonymous (2005) compared the operation modes of third-party logistics and fourth-party logistics, and pointed out that logistics service outsourcing can find the best organization for the supply chain of manufacturers and retailers and bring greater economic benefits for enterprises. Stone (2001) analyzed the expansion steps they use in a single European market through a survey of several British logistics service providers expanding in the European market, and assessed the impact of logistics service outsourcing on the performance of European supply chain management from aspects of management philosophy, financial organization, marketing and information technology. Cho. J. K (2001) studied the relationship between logistics service outsourcing and enterprise development performance, whose results show that whether in the e-commerce business environment or in the traditional business environment, enterprises must have strong logistics service capabilities if they want to achieve better business performance, and this logistics service capability is often realized through logistics outsourcing.

Domestic research on logistics service outsourcing has been paid more attention. Xu Juan (2007) discussed the random factors of logistics outsourcing from aspects of market demand, conversion cost, unit price and management cost, used the real option theory to establish the decision model of logistics outsourcing, and carried out the simulation analysis. The results show that the higher the conversion cost and outsourcing price, the higher the option value. Comparatively speaking, market demand and management cost have little influence on the value of options. Liu Lijun (2006) analyzed the advantages and disadvantages of logistics outsourcing from two aspects of enterprise tactics and strategy, regarded the evaluation and selection of logistics service providers as an important link of logistics outsourcing, and qualitatively analyzed the decision-making methods of logistics outsourcing. Meng Xiangru (2004) analyzed the importance of logistics service outsourcing, explained the mechanism of logistics outsourcing by using transaction cost theory, analyzed the different situations of logistics service outsourcing from the specificity of assets and the complexity of logistics services, and put forward the corresponding outsourcing strategies. Wang Ting (2010) applied the principal-agent theory to establish the

principal-agent model of agricultural product logistics outsourcing, analyzed the benefit distribution mechanism between the agent and the principal in the agricultural product demand market, discussed the optimal incentive intensity and effort level of principal and agent in the case of information symmetry between the two sides, and distributed the benefits brought by the joint efforts of both parties at the same time. Liang Jing (2009) studied the incentive mechanism of both parties in the process of logistics service outsourcing under the conditions of non-information sharing and information sharing. The research shows that in the case of non-information sharing, 3PL can promote Pareto improvement only by improving the level of effort. In the case of information sharing, the fluctuation of 3PL income becomes stronger, and improving the effort level of both the contractor and the contractor can promote Pareto optimality. Liu Yanrui et al. (2010), according to the principle of profit maximization of enterprises and taking the basic demand function as the starting point, made a quantitative analysis of logistics service outsourcing from income and cost. The calculation results helps to further expound the importance and necessity of logistics service outsourcing. Yao Jianming (2010) constructed the overall framework of enterprise logistics operation, analyzed the influencing factors of enterprise logistics outsourcing decision-making, and analyzed the influencing factors and interrelations by using structural equation model through the results of questionnaire survey, to provide a reference for enterprise logistics service outsourcing decision-making. Chen Lequn (2008) used the principal-agent model as the theoretical basis to analyze the risks in the process of logistics service outsourcing from the aspects of consignor adverse selection caused by pre-information asymmetry and agent morality caused by post-information asymmetry, thus the corresponding avoidance strategies were put forward. Peng Benhong (2008) analyzed the trust relationship with logistics outsourcing enterprises in the process of logistics service outsourcing, and established a trust game between the two sides by using abandonment theory. Through the analysis, it is concluded that in the repeated game, only the cooperation with trust as the premise can be established and puts forward the risk prevention strategy in the process of logistics outsourcing. Based on the theory of core competence, Xiao Bin (2008) analyzed the form of logistics outsourcing from different logistics modes, established the evaluation index of logistics outsourcing mode selection, and verified the effectiveness of the method through an example. Liang Jing, Cai Shuqin, Wu Yingmin (2006) studied the logistics outsourcing system

composed of 3PL, suppliers and manufacturers, and constructed an incentive mechanism model in a collaborative work environment. The research shows that when the principal has a low level of effort, information sharing has little effect on the incentive, while in the case of a high level of effort, information sharing has a greater effect on the incentive of agents. On the basis of expounding the connotation and advantages of logistics outsourcing, Li Baozhu (2010) constructed the comprehensive evaluation index system of enterprise logistics outsourcing level, established the mathematical model of the evaluation system by using the method of network analysis, and solved the model. Zhao Zhuwen (2010) applied the abandonment analysis method to construct the abandonment model of logistics outsourcing cooperation between manufacturers and logistics enterprises, and analyzed that in the case of non-cooperative equilibrium, the service quality defect rate of logistics service providers determines the benefits of logistics providers and manufacturers. Liu Weihua, Liu Xilong, he Dengcai (2009), through a large number of case studies, compared and analyzed the modes of complete self-management, partial logistics outsourcing, logistics system divestiture, logistics strategic alliance, logistics system takeover and complete logistics outsourcing, foundthe main factors that affect China's manufacturing logistics service outsourcing, and pointed out the development ways of China's manufacturing logistics outsourcing.

(3) Research on the Structure of Logistics Service Supply Chain

The structure system of logistics service supply chain is one of the main contents of logistics service research, which includes the composition and research content of logistics service supply chain. SCHMIDT et al. (2000) studied the strategic, tactical and operational decision-making problems of international logistics, and presented a structural model of logistics service supply chain including purchasing and transportation functions. CHOY K L et al. (2001) proposed that logistics service supply chain was a supply chain with the basic structure of functional service provider-logistics service integrator-customer. They took the logistics development in southern China as an example, and proposed to use logistics information management integration system (ILIMS) to solve the uncertainty of logistics service supply chain. HOKEY et al. (1994) designed a decision support system including procurement, manufacturing and distribution for the logistics service supply chain network of multinational corporations, and constructed a logistics service supply chain

management platform. Wang and Sang (2005) analyzed the relationship between third-party logistics enterprises and supply chain members, and emphasized that 3PL should re-engineer its own logistics business to adapt to customers and maximize customer value. By designing five intelligent agents, a logistics service supply chain management platform based on 3PL system was constructed. GORAN PERSSON et al. (2001) proposed the classification of logistics service providers, which can be divided into categories according to complexity and asset specificity. Those with low complexity and asset specificity are basic logistics service operators, and those with low complexity and high asset specificity are specialized logistics service providers. Those with high complexity and low asset specificity are advanced logistics network providers, and those with high complexity and high asset specificity are logistics service integrators. At the same time, it can also be divided into four categories according to whether it is entity-based or demand-based positioning. Physical operations and changes are not strong for logistics operators, non-physical operations and changes are not strong for logistics agents, physical operations and changes are strong for third-party logistics providers, and non-physical operations and changes are strong for logistics integrators. Lisa M. Ellram et al. (2004) constructed a logistics service supply chain management framework by comparing the adaptability of three product manufacturing supply chain models based on GSCF, SCOR and Hewlett-Packard, and combining the characteristics of logistics service supply chain. Dirk de Waart et al. (2004) established a logistics service supply chain framework based on organizational decision-making, system and tools, and performance management. Rabinovich and Knemeyer (2006) investigated a large number of vendors' logistics service networks through examples, analyzed and summarized the characteristics of logistics service providers which can bring greater benefits to the logistics service supply chain system, posing reference significance to the construction of logistics service supply chain.

Domestic scholars have also done research on the construction of logistics service supply chain. Tian Yu (2003) expressed the basic structure of logistics service supply chain as: functional logistics service provider→logistics service integrator→manufacturing enterprise→retail enterprise. Among them, functional logistics service provider refers to traditional functional logistics enterprises such as transportation enterprises and warehousing enterprises. Cui Aiping et al. (2008) gave the definition of logistics service supply chain according to the characteristics of

invisibility, heterogeneity, non-storability and customer influence of logistics service, and described the logistics service supply chain as a network structure model composed of second-level logistics subcontractors, first-level logistics subcontractors, logistics service integrators and logistics service demanders. Guo Junfang et al. (2009) , on the basis of analyzing traditional supply chain integration technology, expounded the idea of service-oriented integration and its implementation process, proposed a service-oriented logistics supply chain information system integration model, and gave an example of Web service provided by a manufacturer. According to the example of logistics service integrator, Zhang Dehai et al. (2007) analyzed the architecture design of business intelligence system oriented to logistics service supply chain by using the construction principle of business intelligence system, and expounded the whole process of decision-making by using data warehouse, data mining and on-line analytical processing technology. Yan Xiuxia et al. (2005) constructed the structure model of logistics service supply chain based on the idea of supply chain management, established the evaluation index system of logistics service supply chain model from three attribute domains: hierarchical domain, operation domain and constituent domain, and evaluated the performance of the model by using technology and Analytic Hierarchy Process (AHP). Zhang Dehai and Liu Dewen (2009) applied fault tree analysis to solve the minimum cut set, subdivided the reliability index into the enterprises that provide one or more logistics functions, and constructed the service capability optimization model of logistics system, using the whole vehicle logistics as an example to verify the feasibility and effectiveness of the method. Combining the characteristics of service supply chain, Li Hong (2010) analyzed the operation and management of logistics service supply chain from the perspectives of prediction and resource planning, reservation and capacity resource management, and put forward the key technologies needed for the successful operation and management of the service supply chain and problems to be faced in the operation process. Gao Zhijun and Liu Wei (2009) used qualitative analysis to describe the concept and structure model of logistics service supply chain, and analyzed the operation power, operation process and the depth and breadth of logistics capability integration of logistics service supply chain. On this basis, they put forward that the logistics service supply chain was a value-added chain of logistics capability, and the win-win situation of all node enterprises in the whole logistics service supply chain can be realized by integrating logistics capability.

(4) Research on Coordination Mechanism of Logistics Service Supply Chain

The benefit distribution and coordination among the constituent members of logistics service supply chain is one of the key issues of logistics service supply chain, which plays a decisive role in the formation and operation of the cooperative alliance of the service supply chain. SPINLER et al. (2006) applied the option contract to the production capacity decision of non-storable goods or data services, and analyzed the optimal strategy of both sides of logistics service transaction under the condition that the contract market and the spot market exist at the same time. Fang et al. (2007) proposed the option contract as a means of price discrimination for monopoly logistics service providers under uncertain demand, so as to improve the investment efficiency and capacity allocation efficiency of logistics service capacity. ZHOU Yongwu et al. (2007) used Stackelberg abandonment model to analyze how a single manufacturer and retailer solve the coordination problem of logistics service supply chain through price-quantity strategy under random demand; HSIEH C C et al. (2008) studied the coordination problem of a decentralized logistics service supply chain composed of single equipment supplier, manufacturer and distributor under uncertain demand and supply, and constructed three coordination models. QIN Yiyan et al. (2007) studied how the quantity discount and royalty coordination mechanism can play a coordinating role in the logistics service supply chain system composed of a single supplier and retailer in the face of price-sensitive demand. ARCELUS F J et al. (2006) studied the coordination between manufacturers and logistics service providers in the secondary market under uncertain logistics service demand, and put forward a regression policy for manufacturers to share the risk of logistics service providers. Baker et al. (2002) considered the incentive problem of relational contract, emphatically analyzed the difference between logistics service outsourcing and self-built logistics service network, and revealed that the core of enterprise logistics network was the incentive problem of relational contract. Kevin R Moore et al. (1998) found the relationship of trust in logistics service supply chain and constructed a decision-making power allocation model. Wei S L et al. (2000) designed an incentive mechanism model based on principal-agent theory in the study of third-party logistics provider relationship. Frank Chen et al. (2001) designed a service pricing model in the logistics service supply chain, and put forward the view that a certain revenue-sharing contract can promote close cooperation among all parties, but did not construct a

revenue-sharing contract model. Cooke J et al. (1996) considered that effective contract is an important part of logistics service cooperation mechanism in analyzing how to establish a stable third-party logistics relationship. Maltz A. B et al. (1997) analyzed the decision-making of enterprise logistics outsourcing and established a total cost allocation contract model by using ABC method.

On the domestic side, Liu Weihua, Ji Jianhua and Zhang Tao (2008), on the basis of the logistics service combination model, in the case of one logistics service integrator and multiple functional logistics service providers, used the principal-agent theory to establish an optimization model between logistics service integrators and functional logistics service providers. Fan Qi et al. (2008), on the basis of the analytical framework of the master-slave structure between third-party logistics providers and subcontractors in the supply chain, studied the incentive problem in the revenue sharing of the logistics service supply chain, put forward a variable weight incentive model for the optimal allocation of revenue and the corresponding variable weight incentive strategy, and discussed the solution method of the model. In order to solve the coordination problem of logistics service supply chain under uncertain demand, Gui Yunmiao et al. (2009) proposed a coordination method of competitive alliance, established a mathematical model of centralized coordination, Stackelberg master-slave coordination and competitive alliance coordination under the condition of price-sensitive random variables of market demand, and analyzed the realization conditions of optimal solutions of different coordination methods. Huang Guangming et al. (2008) constructed a two-stage dynamic model, analyzed the coordination of logistics service supply chain with changes in price and demand, and adopted an improved revenue sharing contract to achieve perfect coordination of logistics service supply chain system. Li Lin et al. (2007) studied the coordination of service booking in a two-level logistics service supply chain between a single retailer and a single supplier under the condition of elastic demand by using the dual strategy of sharing transportation costs and common replenishment period. Zhang Dehai and Liu Dewen (2008) constructed the information sharing system of logistics service supply chain, designed the incentive mechanism of information sharing by using the modified Groves mechanism, and illustrated the feasibility and effectiveness of the incentive mechanism by a specific example. Tian Yu and Wu Peixun (2006) constructed a two-stage logistics service supply chain revenue-sharing contract model and a three-stage logistics service supply chain revenue-sharing contract model by selecting

the quantitative ratio of wholesale price and sales income, and put forward the conditions for the validity of revenue-sharing contracts under different models. Aiming at the three-stage logistics service supply chain model, they put forward a view that the enthusiasm of all parties in the logistics service supply chain can be promoted through the adjustment of contract parameters, discussed the necessary conditions for the establishment of a revenue-sharing contract, and used examples to test it. Chen Zhisong (2008) established the revenue-sharing contract and wholesale price contract in the third-party logistics service supply chain based on the Stackelberg master-slave game decision method, studied the optimal service order quantity in the supply chain, established the Nash equilibrium model between the logistics provider and the logistics subcontractor, and obtained the optimal quality cost input under the constraint of the optimal service order quantity. Ma Cuihua (2009), on the basis of the analysis of the connotation of logistics service capability, studied the coordination mechanism of logistics service supply chain from aspects of the investment of relational special assets among enterprises, the sharing of information and knowledge among enterprises, the complementary integration of resources, and the regulation of enterprise behavior in logistics service supply chain. Fengfei et al. (2009) put forward three cooperative operation modes of logistics service supply chain based on the different cooperative relationship and degree of members of each node of logistics service supply chain: point chain coordination, line chain coordination and full chain cooperation. Taking the line chain coordination model as an example, they discussed the cooperative operation mechanism of logistics service supply chain. Zhang Chenyan (2007) analyzed the problem performance and root causes of logistics service supply chain coordination, analyzed the formation mechanism of supply chain coordination by using relevant economic theory, expounded its coordination mechanism, and established a collaborative management system combined with e-commerce model.

Zhang Zhiyong (2009) established the cooperative abandonment model between port enterprises and other logistics service providers, analyzed the necessary conditions for the formation of port logistics service supply chain, discussed the deficiency of benefit distribution in port logistics service supply chain by using Shapley value method, and put forward the application of improved Shapley value (weighted Shapley value) in port logistics service supply chain benefit distribution for the first time.

(5) Research on Other Aspects of Logistics Service Management

In addition to above research contents, foreign scholars have also studied the dynamic characteristics of logistics services, relationship management, information management, and performance evaluation. K.L. Choy et al. (2007) studied the establishment of a logistics information management integrated system under uncertain conditions, which aims to integrate business processes and reduce uncertainty by increasing information transparency, so as to effectively manage the information flow among participating enterprises in the logistics service supply chain. Sengupta, Heiser and Cook (2006) applied the traditional supply chain strategy to the corporate operation and financial performance evaluation of the manufacturing industry and the logistics service industry respectively, studied and compared the similarities and differences between the two industries to prove that the effective supply chain strategy for one industry is not necessarily suitable for another industry, and provided decision-making basis and strategic choice basis for enterprise managers. Casaca and Marlow (2005) obtained the relevant data of European short-haul shipping market by questionnaire, analyzed the service attributes and external environment that affect the multimodal logistics chain, and predicted the future logistics development trend in Europe. Hertz (2003) focused on the strategic design of 3PL, discussed how to balance the contradiction between the general ability to solve problems and customer customized logistics services, pointed out that 3PL should be based on the existing logistics network and business in the initial stage, and then gradually abandoned the traditional business and developed to the advanced and complex service stage. Anderssona and Norrman (2002) pointed out that enterprises should follow the trend of economic development, analyzed the influencing factors of the logistics procurement process, further subdivided the procurement process, enabled integrators to provide integrated logistics service solutions to customers, and customized basic and advanced logistics services, so as to make logistics procurement services more effective. Aminia et al. (2005) proposed that maintenance service depended on reverse logistics, and the operation of reverse logistics supply chain was much more complex than that of manufacturing supply chain, and it was not easy to be copied by competitors. They analyzed the value of maintenance service and the importance of effective operation of reverse logistics, and designed the reverse logistics operation scheme of maintenance service supply chain through case study.

Myers, Mentzer and Cheung (2004) pointed out that logistics service had become a significant source of competitive advantage differentiation of enterprises. Furthermore, logistics service quality elements can be used to divide logistics service customers horizontally or vertically, while culture and organizational characteristics can modify the relationship between customer satisfaction and logistics service quality.

Domestic scholars have done research on logistics service risk management, selection and evaluation of logistics service providers. Song Danxia et al. (2009) analyzed the characteristics of service supply chain from aspects of supply chain structure, supply chain management content, supply chain operation mode and supply chain stability in *Research on the Characteristics of Service Supply Chain Management Mode and Performance Evaluation System*. They constructed a customer-oriented, service process-based, universal and effective service supply chain performance evaluation system based on customer value, collaborative development performance and service operation performance. Based on the study of the connotation of service supply chain, they established a service supply chain management structure model based on productive service outsourcing, and put forward a productive service supplier selection and evaluation system from the perspective of service supply chain, including six second-level indexes of service quality, service price, service capacity, service flexibility, cooperation ability and development potential, and eighteen third-level evaluation indexes. In addition, they carried out practical verification by using the evaluation method of the combination of Analytic Hierarchy Process and entropy method (Song Danxia, Huang Weilai, 2010). Jiang Fangtao (2009) constructed the overall performance evaluation index system of the supply chain, gave the steps of the fuzzy comprehensive evaluation method, and finally used the method to evaluate the performance of supply chain enterprises from a quantitative point of view. Liu Renjun et al. (2007) put forward the research framework of supply chain logistics deepening based on relational contract. From the perspective of relational contract, they analyzed the mechanism of specific asset investment and social capital on supply chain logistics service deepening and content deepening, established an index system to measure supply chain logistics service deepening, and put forward policy suggestions to promote supply chain logistics service deepening and management mode innovation in China. Ren Jie (2006) established a comprehensive evaluation index for the selection of integrated logistics suppliers, determined the weight of experts and influencing factors by Analytic

Hierarchy Process, and calculated the priority scores of candidate enterprises for each factor by using the method of fuzzy evaluation to realize the ranking and selection of integrated logistics service providers. Guo Mei et al. (2007) proposed an index reduction method based on fuzzy rough set in order to solve the problem of too many indexes in the performance evaluation of logistics service supply chain by constructing the closeness degree of the evaluated object to the ideal point. Based on the analysis of the connotation of logistics service supply chain, Liu Juan (2008) put forward indexes that affect the evaluation of logistics service supply chain through frequency statistics and theoretical analysis, and used the improved grey correlation method to evaluate the performance, and finally obtained the optimal service supply chain. In the process of studying the influencing factors of the core competitiveness of logistics service supply chain, Li Qian (2009) found that the cooperation motivation and default risk among logistics enterprises are one of the important reasons, divided the default risk of two-level logistics service supply chain into logistics service integrator default risk and functional logistics enterprise default risk, and analyzed the logistics service supply chain default risk including external and internal causes. Based on the study of logistics service supply chain and its risk, Gao Zhijun et al. (2010) analyzed the causes of risk in logistics service supply chain, improved the five-stage model of risk management by studying the process model of risk management, and established the risk management model of logistics service supply chain, which enriched the theory of risk management.

2.5 Research Review

At present, the current research of iron and steel logistics pays more attention to the construction of theoretical model, the analysis of macro policy and regional strategy, but the analysis of specific cases is rare for a variety of reasons. Therefore, there is still a certain gap between theoretical research and front-line practical application.

Here, 12 thesis are specially taken out for analysis.

Table 2-1 Analysis of Shortcomings of Previous Literature

No.	Previous Literature	Previous Findings	Research Deficiency
1	B. M. Beamon. Measuring Supply Chain Performance.	The enterprise performance management system is constructed,	The research focuses on the internal performance of

	International Journal of Operations and Production Management. 1999,19(03):275-292.	which includes three aspects, including resources, flexibility and output. The indexes of resources are: manufacturing cost, distribution and sales cost, inventory cost, total cost and return on assets, while the indexes of enterprise flexibility mainly include: product flexibility, quantity flexibility, time flexibility and mixed flexibility; output indexes are: profit, sales, customer response time, order satisfaction rate, manufacturing lead time, just-in-time delivery, delivery errors, out of stock and customer complaints.	enterprises, but fails to analyze it from the perspective of upstream-enterprise-downstream logistics supply chain.
2	P. C. Brewer, T. W. Speh. Using Balanced Scorecard to Measure Supply Chain Performance. Journal of Business Logistics, 2000,21(01):75-93.	This thesis puts forward a set of performance management system based on balanced Scorecard for the supply chain management of modern enterprises, and tries to assess the actual performance of supply chain management from four aspects of the enterprise. specifically: 1 the goal of enterprise supply chain management; 2 the actual interests of the final customers of the enterprise; 3 the overall financial interests of the enterprise; 4 the medium-and long-term development of enterprise supply chain management.	The research is based on the theory of balanced Scorecard, but it does not reflect the four principles of logistics: timely, accurate, safe, economic, and does not highlight the characteristics of green, ecological, systematic and innovative.
3	G. J. Schultz. Keeping SCOR on Your Supply Chain. Basic Operations Reference Model Updates With the Times Information Strategy. Journal of Business Logistics,2003,19(04):12-20.	In the SCOR classical model, several comprehensive indexes of general enterprise supply chain performance management are put forward, such as the satisfaction of order and delivery, the flexibility of production and manufacturing, the rapid response time of the whole supply chain, the management cost of enterprise logistics	The research focuses on measuring the supply chain performance management of general enterprises, and there is a lack of specific index analysis of iron and steel logistics.

		activities, the production efficiency of all kinds of added value, the turnover days of enterprise cash flow, the inventory cycle of enterprise supply turnover and the turnover rate of enterprise assets.	
4	James H. Martina, Bruno Grbac. Using Supply Chain Management to Leverage a Firm's Market Orientation[J]. Industrial Marketing Management, 2003(32):25-38.	The common characteristics of supply chain performance indexes are summarized, such as extensiveness, versatility, testability and consistency.	Failed to keep pace with the times, and failed to implement in iron and steel logistics, high-quality logistics and other related fields.
5	Editorial. Supply chain management: Theory and applications[J]. European Journal of Operational Research, 2004,159:265-268	It is proposed to measure and evaluate the supply chain from three aspects: resources, output and flexibility.	The assessment indexes are not comprehensive enough, especially the lack of consideration of customer satisfaction.
6	Mallik S, Harker P T. Coordinaling supply chains with competition: capacity allocation in semiconductor manufacturing[J]. European Journal of Operational Research, 2004,159:330-347.	It is considered that the supply chain performance evaluation should be analyzed from the strategic, tactical and operational aspects, and the planning, resources, manufacturing and delivery factors should be considered.	The evaluation of the research failed to fully take into account customer satisfaction, failed to take into account the fierce competition faced by logistics enterprises in reality, and customer-centered is also more in line with the requirements of practice.
7	Chen Zhixiang. Research on Performance Evaluation index System of Agile Supply and Demand Coordination [J]. Computer Integrated Manufacturing System, 2004, 10 (01): 99-105.	Focus on the four areas of information, logistics, capital flow and work coordination in inter-enterprise supply and demand coordination, construct a set of multi-objective scientific and reasonable performance management evaluation system, which is suitable for enterprise performance evaluation of supply and demand coordination in agile supply chain, and further set up a specific quantitative measurement and	Failed to formulate an index system in line with the iron and steel logistics industry.

		calculation method for all kinds of indexes in the system.	
8	Qu Shengdian. Systematic Research on Supply Chain Performance Evaluation [D]. Harbin Institute of Technology, 2006.05.	Through the empirical study on the performance management of power equipment manufacturing industry, it is pointed out that the degree of excellent performance can be in the following order: customer satisfaction, elasticity, supplier performance, cost and profit. At the same time, the improved balanced Scorecard is used to establish the performance evaluation system model for the enterprise's finance, customer, internal business process, learning and growth to verify the practicability and effectiveness of the improved balanced scorecard in enterprise performance management evaluation.	Failed to focus on customer satisfaction, quality, efficiency and other aspects. The practical significance and maneuverability are insufficient.
9	Ma Shihua, Chen Tiewei. Research on Constituent Elements and Evaluation Methods of Logistics Service Capability based on Supply Chain [J]. Computer Integrated Manufacturing System-CIMS,2007,15 (04): 744-750.	The overall performance evaluation system of supply chain is constructed, and it is considered that the performance effect of supply chain includes two aspects: customer value and supply chain value.	In addition to customer value and supply chain value, logistics supply chain system is also safe, green, and efficient. This is what the research lacks.
10	Ye Fei, Xu Xuejun. Performance Evaluation index System and Evaluation Method of Dynamic Alliance [J]. Theory and Practice of Systems Engineering, 2009 (09): 117-119	Evaluation indexes are divided into supply chain internal evaluation indexes, external evaluation indexes and comprehensive evaluation indexes.	In the modern competitive market environment, it fails to think fully from the perspective of customer satisfaction.
11	Fan Yuqing. Research on the Integration Mode and Operation Mechanism of	The evaluation index system of the integration level of iron and steel logistics resources is constructed. From	The research failed to focus on the process evaluation of iron and steel logistics, especially did

	Iron and Steel Logistics Resources from the Perspective of Supply and Demand [D]. Beijing Jiaotong University, 2018.06.	five aspects: the integration level of iron and steel logistics infrastructure resources, the integration level of iron and steel logistics organization resources, the integration level of iron and steel logistics information resources, the service level of iron and steel logistics and the income level of iron and steel logistics. the evaluation index system of the integration level of iron and steel logistics resources is constructed, and the fuzzy comprehensive evaluation model is used to verify the feasibility of the evaluation system.	not consider safety, quality, customer satisfaction and other aspects; and the research is more limited to the theory, failed to combine the opinions of front-line experts, the index system is not operable and timely.
12	Gai Qingxia. Research on Customer Service Quality Satisfaction of Logistics Enterprises [J]. Logistics Engineering and Management, 2019, 41 (04): 59-61＋58.	Customer service satisfaction can be used as a standard to measure the quality of products or services provided by logistics enterprises.	Customer satisfaction is important, but it is not comprehensive, and other key factors such as quality, safety, green, and efficiency are not taken into account.

Through literature review and analysis, we can see that the research of logistics service supply chain has been favored by more scholars. After the development in recent years, some research results have been achieved both in theoretical research and practical application, focusing on the connotation, structure, supplier selection and coordination mechanism of the service supply chain. However, with the development of social logistics and the change of new market environment, the research field of logistics service supply chain has been continuously expanded. The research about how to promote the formation and effective operation of logistics service supply chain is still relatively insufficient according to existing literature, mainly in the following aspects.

First, as a new science, service science just started in China. There are many qualitative studies in domestic literature, but relatively few quantitative studies. Logistics service supply chain, as a special service management, is relatively less than

the general supply chain research results home and abroad, and the theory is not mature enough.

Second, the definition and basic framework model of logistics service supply chain have not yet reached a clear conclusion. As an important trend of future research to further clarify the concept, the attribute and model of logistics service supply chain, it lays the foundation for the systematic study of the basic theory of service supply chain. At present, there are few systematic studies in this area.

Third, there are similarities between logistics service supply chain and product supply chain, and there are also great differences objectively. Most of the existing literature aims at product supply chain, but there are relatively few literature to study the coordination mechanism of service supply chain based on these differences. But this is a very important content for service supply chain, which directly affects the formation of cooperative alliance.

Fourth, in the selection of service providers and the overall performance evaluation, most of them take convenience, speed, economy and other indexes as the main considerations. While in China there is a lack of resources and environmental damage, the development of low-carbon economy has put forward higher requirements for the development of logistics service industry, and the relevant literature considering these factors in supplier selection and performance evaluation is rare.

In recent years, with the rapid development of logistics industry, logistics service has become a hot issue in the academic and business circles home and abroad, and the good management and operation of logistics service industry needs an integrator and coordinator. At present, the research on logistics service supply chain and logistics service integration mechanism from the perspective of integration is still in the primary stage. At the same time, the research of service supply chain should combine service supply chain with manufacturing supply chain to gradually improve and extend the theory of supply chain management.

At present, there is not much research literature on carbon emission control model home and abroad, and the research in China is lack of specific application case study of iron and steel supply chain, and the relevant supporting theory is not complete. As a senior participant in iron and steel logistics, the green level of BJ's logistics activities leads the whole steel logistics industry to a new level, and is even related to the green development of the whole social logistics. Therefore, this thesis

intends to summarize the practice of BJ, finds its shortcomings and development direction, and makes a certain contribution to the research in this field.

This thesis draws on advanced theories and practice cases on performance management at home and abroad, combines practical problems of domestic steel logistics companies, proposes a set of performance management solutions suitable for steel logistics companies to provide useful reference to more companies in the industry. In addition, it plans to add green and low-carbon factors to the development of the steel logistics enterprise performance evaluation system, which provides a landing platform and experimental field for the evaluation of the green level of the steel logistics industry.

3 Related Theoretical Basis

This part will analyze theories from six aspects of total quality management, lean management, SCOR model, green evaluation of logistics industry, service quality theory, and balanced scorecard theory, laying a theoretical foundation for the construction of subsequent quality evaluation indexes.

3.1 Total Quality Management

3.1.1 Quality

The idea of quality can be traced back to the Spring and Autumn and Warring States period. *Zhou Li-Kao Gong Ji* gave a detailed description of the quality of handmade products-it is said that when craftsmen make utensils, they should carefully examine the curvature and straightness and deal with the materials according to different conditions, which is to limit the specifications, types, raw material composition and qualification of handmade products. In a popular way, quality refers to the quality of a product or service. Based on the understanding of quality, people add a lot of qualifiers to form more specific and clearer expressions such as product quality, service quality, and engineering quality. In fact, the meaning of quality is rich, and people can understand, explore and excavate it from different angles.

This thesis holds that the most accurate definition of the concept of quality comes from IS09000, that is, quality is the degree to which a group of inherent characteristics meet the requirements. This definition is general and clear, which directly shows that the core issue of the concept of quality is a set of inherent characteristics, and the evaluation of quality should start from the extent to which it meets the requirements.

3.1.2 Quality Control

Quality management, a subject which takes quality as the research object, studies and reveals the objective law of the generation, formation and realization of quality. Because quality management has a very close relationship with economics, management and mathematics, it is a comprehensive discipline. At the same time, quality management is a discipline with strong application, if we simply discuss quality management without specific products or objects, it is meaningless. Only by

combining management with technology, analyzing practical problems and studying physical objects or products, can we really explain the connotation of quality management.

The content of quality management is divided into micro and macro aspects. At the micro level, quality management is related to the improvement of the quality of products and services of enterprises, to construct and improve the quality management system, study the functions and operation mechanisms that should be reflected by various functional departments of enterprises in the process of quality management, and apply the methods of quality improvement and quality statistics. At the macro level, quality management focuses on the impact of national economic and social environment on enterprise product quality, and studies economic, legal, administrative, measures and means that can affect enterprise product quality.

The content of quality management includes the formulation of quality policy and quality objectives, as well as quality planning, quality assurance, quality control, and quality improvement.

(1) quality policy: the general quality purpose and direction of the organization. It is officially issued by the top management of the organization, is the guiding ideology and commitment of enterprise managers to quality, and is an important part of the general policy of enterprise management.

(2) quality goal: the goal of quality pursued according to the quality policy of enterprise.

(3) quality planning: formulate the quality objectives and stipulate the necessary processes and resources that enterprise should carry out at the same time.

(4) quality control: with the goal of meeting the quality requirements, control the people, machine, material, method and environment that affect the product quality.

(5) quality assurance: on the basis of quality control, it leads to the action with the goal of trust, and is usually divided into internal and external quality assurance.

(6) quality improvement: activities to improve quality management systems, processes and products with the goal of enhancing the ability of enterprises or organizations to meet quality requirements.

As shown in Table 3.1:

Table 3.1 Concepts of Quality Management

No.	Term	Contents
1	The	Macro: the influence of national economic and social environment on the

	Connotation of Quality Management	product quality of enterprises. Micro: improve the quality of products and services of enterprises, so as to construct and improve the quality management system.
2	The Content of Quality Management	● Quality policy: the general quality purpose and direction of the organization, officially issued by the top management of the organization, is the guiding ideology and commitment of enterprise managers to quality, and is an important part of the general policy of enterprise management. ● Quality goal: the goal of quality pursued according to the quality policy of the enterprise. ● Quality planning: set quality objectives and stipulate the necessary processes and resources that should be carried out by the enterprise. ● Quality control: to meet the quality requirements as the goal, to control the people, machines, materials, methods and environment that affect the product quality. ● Quality assurance: on the basis of quality control, and then leads to the action with the goal of trust. It is usually divided into internal and external quality assurance. ● Quality improvement: activities to improve quality management systems, processes and products with the goal of enhancing the ability of enterprises or organizations to meet quality requirements.

3.1.3 Total Quality Management

(1) Meaning

Total Quality Management, TQM, is originated in Japan and the United States in the 1950s. General Electric Quality Manager A.V. Feigenbaum (1961) believed that total quality management meant that enterprises fully consider customer needs under the most economical conditions, and built a system that can improve and maintain quality through market research, product design, production and service. According to the actual situation of quality management in Japanese enterprises, Ishikawa put forward that total quality management is the quality management of all the activities of the enterprise. In this process, all personnel of the enterprise (including senior managers and ordinary employees) should participate in quality management activities.

According to the definition of total quality management by A.V. Feigenbaum and Ishikawa, this thesis holds that total quality management is a management mode in which people-oriented enterprises are participated by all staff, and scientific quality decisions and methods are adopted to continuously improve the quality management

of the whole process to ensure that the narrow and broad quality of products meet and exceed customer requirements to benefit all stakeholders. Among them, people-orient and full participation means fully mobilizing people's subjective initiative and letting all personnel of the enterprise participate in the action of learning quality, creating quality and surpassing quality. In the narrow sense, quality refers to the performance of the product; in the broad sense, quality refers to the reliability, efficiency, life and quality cost of the product. Customer needs include the current, potential and future needs of customers. Stakeholders refer to leaders, employees, suppliers, partners, and social groups of the enterprise.

(2) Content

The core of total quality management is to run the idea of comprehensive control through the whole process of enterprise or organizational quality management, and at the same time adopt the method of prior control and inspection and the method of establishing statistics to control the whole process of quality. *Three complete and one diverse* is the best summary of the content of total quality management, which includes full participation, whole process control, full scope of organization or enterprise as the object, and adopts a variety of methods to carry out quality management.

First, full participation. It is necessary to educate and train all employees of the organization or enterprise in order to achieve the goal of improving quality awareness, working ability and self-management. At the same time, it is also necessary to clarify the quality responsibilities of departments and posts related to quality, so as to stimulate the enthusiasm and creativity of all staff to participate in quality management.

Second, the whole process control. The idea of prior quality control runs through every link of enterprise management activities, and the idea of customer service is established. Here, the customer not only refers to external consumers of the organization or enterprise, but also refers to the next process or the next link.

Third, the full scope of the organization or enterprise as the object. Total quality management should not only control the quality of products, but also control the quality of work, service, cost, risk and other aspects related to quality.

Fourth, multi-methods. A variety of methods must be adopted for total quality control, stemming from the complexity of the factors affecting quality, which can be internal factors, external factors, human and technical factors. Therefore, a

comprehensive, systematic and multi-method quality management approach must be adopted for products and services.

(3) Principle

The eight principles of quality management are also the principles and guiding ideology of total quality management.

Total quality management must follow the following eight basic principles:

First, take the customer as the focus. If the enterprise wants to develop, it must cater to the market, and the main body of the market is the customer, so the enterprise must adhere to the concept of customer first, and the quality management of the enterprise must meet or even exceed the customer's expectation. Therefore, taking the customer as the focus is the first principle of total quality management. In the stage of product research and development and market research, enterprises must understand the current and future needs of customers for product quality. Only in this way can the enterprise achieve long-term development.

Second, give full play to leadership role. Leaders are the bellwether of enterprise development. If leaders cannot understand and apply the theory of total quality management, this enterprise will be with defects in quality management, which is not conducive to the rapid development of the enterprise. If an enterprise wants to produce high-quality products, leaders must first attach importance to quality management and take the lead. Whether in corporate culture or work meetings, they should emphasize the importance of quality management. At the same time, they should also provide quality education and training for employees to enhance their quality awareness. For those who do not implement in accordance with the quality management system, we should give punishment to improve their attention to quality management.

Third, mobilize full participation. An excellent enterprise, in addition to the exemplary leading role of leaders, needs to ensure that all employees actively participate, and even the lowest-level employees have some impact on product quality and service. Therefore, to improve the enthusiasm of employees to participate in quality management, we can put the knowledge of total quality management through all aspects of product production and improve the quality awareness of the whole staff, ensure that quality problems of products do not affect the construction period and reputation, so that the quality of products can be controlled and improved. Research and development, investment test, raw material purchase, mass production of

production line, product quality tracking, and new product improvement are the key aspects. The enterprise should improve the qualified rate of product quality through key processes of product (including research, control and improvement), so as to improve the service level of enterprise.

Fourth, value the process method. A more important principle of total quality management of an enterprise is to manage the whole process of production, which includes pre-market research, research and development of new products, investment testing, purchase of raw materials, mass production of production lines, product quality tracking, and improvement of new products. The enterprise should improve the qualified rate of product quality through key processes of product (including research, control and improvement), so as to improve the service level of enterprise.

Fifth, carry out the systematic method of management. The biggest difference between total quality management and other quality management is that it emphasizes that product quality is not a matter of a single department, but an important matter that runs through the whole production system. Therefore, enterprises should adopt a systematic management model in order to control quality problems in all aspects of production and sales, so as to put forward corresponding solutions and take positive measures to ensure that product quality meet the needs of customers to the maximum extent .

Sixth, seek continuous improvement. After decades of continuous development, the theory of total quality management has become more in line with the requirements of enterprise quality management, but enterprises still need to realize that quality management is a process of continuous improvement, especially with the development of the times. Customers' requirements for products have also changed greatly, and enterprises can develop only through innovation to meet customers' greater demand for products by improving product quality and service. Applying the management concept of continuous improvement to all aspects of production can help achieve customer satisfaction of product quality.

Seventh, make decisions on the basis of facts. According to the different characteristics of enterprises, the suitable quality management system is also different. the data obtained by enterprises in social research must be true and reliable in order to help enterprises make scientific and effective quality management decisions. Any management decision related to the development of the enterprise must be based on facts, otherwise, the decision that deviates from the facts will run counter to the real

needs of customers.

Eighth, establish a mutually beneficial relationship with the supplier. A full embodiment of the principle of total quality management is to establish a mutually beneficial relationship between enterprise and supplier, so that all parties get what they need and meet their own interest needs, which is a mutually beneficial and win-win development model. Enterprises, suppliers and customers can jointly improve the quality management of enterprises and further maintain a longer and healthier cooperative relationship.

These eight principles are the most basic principles of total quality management. If enterprises want to implement total quality management smoothly, they should look for other principles that accord with enterprise quality management according to their own characteristics.

As shown in Table 3.2:

Table 3.2 Concepts of Total Quality Management

No.	Term	Contents
1	Connotation	Total quality management is a way of people-oriented and full participation of enterprises, which adopts scientific quality decisions and methods to continuously improve the quality management of the whole process, so as to ensure that the narrow quality and broad quality of products meet and exceed the needs of customers. It is a management model that benefits all stakeholders.
2	Content	First, full participation: it is necessary to educate and train all the employees of the organization or enterprise in order to achieve the goal of improving quality awareness, working ability and self-management. At the same time, it is also necessary to clarify the quality responsibilities of departments and posts related to quality, so as to stimulate the enthusiasm and creativity of all staff to participate in quality management. Second, the whole process control: the idea of prior quality control runs through every link of enterprise management activities, and the idea of customer service is established. Here, the customer not only refers to the external consumers of the organization or enterprise, but also refers to the next process or the next link. Third, the full scope of the organization or enterprise as the object: that is, total quality management should not only control the quality of products, but also control the quality of work, service, cost, risk and other aspects related to quality. Fourth, multi-methods: a variety of methods must be adopted for total

		quality control, which stems from the complexity of the factors affecting quality, which may be internal factors, external factors, human and technical factors. Therefore, a comprehensive, systematic and multi-method quality management approach must be adopted for products/services.
3	Principle	● First, take the customer as the focus. ● Second, leadership. ● Third, full participation. ● Fourth, process method. ● Fifth, the systematic approach to management. ● Sixth, continuous improvement. ● Seventh, make decisions based on facts. ● Eighth, establish a mutually beneficial relationship with the supplier

3.1.4 The Method of Total Quality Management

(1) Quality Management System

The establishment and implementation of quality management system is not only the most effective implementation method of total quality management, but also one of the most important management systems of organizations or enterprises. The purpose of quality management system is to play a commanding role in the quality of the organization or enterprise. The establishment of quality management system, however, is not the purpose, but means and tools to carry out total quality management to improve quality.

The purpose of quality management system is to prove that the organization or enterprise has the ability to provide customers with products that meet their requirements and applicable laws and regulations for a long time and in a stable manner. At the same time, the continuous improvement and effective application of the system can help to achieve the goal of customer satisfaction.

The requirements of quality management system: establish quality policies and quality objectives for an organization or enterprise, put forward and implement related and interactive activities, and put forward corresponding requirements for the inherent characteristics of quality management system.

ISO9000:2015: the main purpose of requirements set in this standard is to give confidence to organizations that provide products and services, thereby improving customer satisfaction. Proper implementation of this standard can also be expected to bring benefits to other organizations, such as improved internal communication, better understanding and control of organizational processes, and reduction of defects and

waste, so that the organization can reach the threshold in a specific way.

Other standards that are included in the coding scope of ISO10000 have been developed to support the implementation of quality management system. These include: customer satisfaction, quality planning, project quality management, configuration management, measurement process and measurement equipment, documentation, finance and economics of quality management, training, statistical technology, people participation and capabilities, selection of quality management system consultants and management system review.

ISO9000:2008: believes that organizations should establish a quality management system in accordance with the requirements of standards, achieve continuous and effective improvement of quality, and record it to achieve the purpose of information communication, conformity evidence and knowledge sharing. However, it should be stated here that there is an obvious difference between the quality management system established according to ISO9000: 2008 and the total quality management system. The former tends to whether the quality system meets the requirements of the standard, while the latter takes the actual situation of the enterprise as the starting point to carry out quality management work.

(2) PDCA Cycle

PDCA cycle was first proposed by Deming, an American quality management expert, so it can be called Deming cycle. It is an important ideological source for the implementation of total quality management.

P (Plan) -- Plan, formulate the plan, purpose and policy of quality activities; D (Do) -- implement, carry out the quality plan that has been established; C (Check) -- check, check the execution of the plan; A (Act) -- deal with the implementation of the plan, summarize the results of the inspection, consolidate those successful experiences, and learn lessons from failures.

PDCA cycle has been widely used in quality management and achieved good results. In fact, the PDCA cycle has gone beyond the scope of quality management and has been widely used in logical work. The PDCA cycle can also be subdivided again into the eight steps shown in Table 3-1.

Table 3-1 PDCA Circle Steps

Stage	Step	Main methods
P	1 Analyze the current situation and find out the problem;	Histogram, control chart

	2 Analyze the factors and causes of the problems;	Fishbone diagram
	3 Find out the key influencing factors and causes.	Correlation diagram, permutation diagram
	4 Make a plan of measures.	5W1H 1. Why did you make this measure? 2. What is the goal of this measure? 3. Where will it be carried out? 4. Who will carry out the execution? 5. When to implement it? 6. How to implement it?
D	5 Carry out the plan.	
C	6 Check the results of the execution of the plan.	Arrangement diagram, histogram.
A	7 Summarize the experience of success and failure, and form the corresponding standard or guidance document.	Modify the existing working procedures and program files.
	8 Import unresolved or emerging problems into the next PDCA loop.	

Source: Wang Dongmei. Basic Knowledge of Total Quality Management [M]. Anhui Science and Technology Publishing House, 2018: 65.

More vividly, it can be shown in figure 3-1:

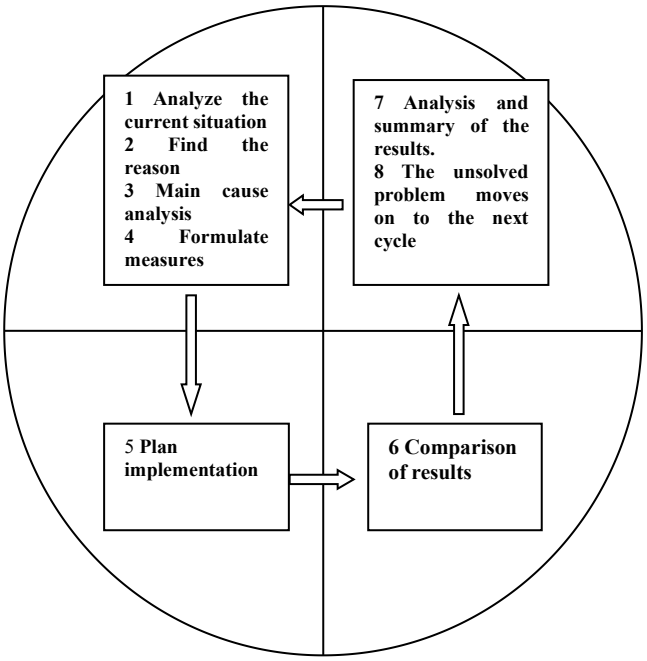

Figure 3-1 Cyclic Distribution of PDCA

Source: Wang Dongmei. Basic Knowledge of Total Quality Management [M]. Anhui Science and Technology Publishing House, 2018: 76.

3.1.5 The Application of This Theory in Study (BJ Company)

Total quality management (TQM) takes product quality as the core and establishes a set of scientific, rigorous and efficient quality system to provide all the activities of products or services that meet the needs of users. Total quality management has the following characteristics:

- Comprehensive: refers to the object of total quality management and the whole process of production and operation of an enterprise.
- The whole staff: means that total quality management depends on all the staff.
- Preventive: means that total quality management should be highly preventative.
- Service-oriented: enterprises use their own products or services to meet the needs of users and serve users.
- Scientific: quality management must be scientific, and we must make more conscious use of modern science and technology and advanced scientific management methods.

For logistics enterprises, the principles of implementing total quality management are as follows:

(1) Whole process control. The quality management of logistics enterprises is a series of complex management activities. In order to ensure the orderly progress of enterprise logistics, the whole process quality control of enterprise logistics production activities must be carried out in order to achieve the goal of enterprise quality management, and then improve the competitiveness of enterprises.

(2) Full participation. The production activity of modern logistics enterprises is a production process of supply chain logistics, which involves the integration and coordination of many resources, requiring related links, departments and personnel to cooperate closely and make joint efforts.

(3) Customer first. To meet the needs of customers to the maximum under certain conditions is the ultimate goal of modern logistics enterprises in providing services. In the process of providing logistics services, by constantly increasing customer satisfaction, the quality management level of logistics enterprises can be gradually improved. The customers include not only the customers outside the enterprise, but also the customers inside the enterprise.

(4) Continuous improvement. With the rapid development of logistics enterprises

and the increasingly fierce competition, people have higher requirements for logistics enterprises, and quality can always be continuously improve, which requires logistics enterprises to continuously improve the quality and reliability of products or services, so as to obtain competitive advantages that other enterprises are difficult to emulate.

For logistics enterprises, the methods of implementing total quality management are as follows:

(1) Enterprises should form the atmosphere of total quality management. When enterprises implement the management method of total quality management within the enterprise, a positive atmosphere of quality first should be formed, so that all employees can gain a sense of honor while pursuing a good logistics quality culture. Outside the enterprise, enterprises need to obtain good corporate reputation and image, obtain the good impression of customers, so as to realize the social value of enterprise.

(2) Introduce the mode of total quality management to improve the quality of logistics service in an all-round way. In order to establish a total quality management system, logistics enterprises must meet the basic requirements of three complete and one diverse, that is, the quality management of the whole process, the quality management of the whole staff, the quality management of the whole enterprise and the quality management of multi-methods. Through the establishment of management model with a total quality management system and mobilizes the whole staff and the whole process, the overall level of enterprise logistics service quality can be improved.

(3) Improve logistics talents training mechanism and improve enterprise logistics quality level comprehensively. Logistics personnel are direct executors of the logistics production process. In order to ensure the quality of logistics, we should pay attention to the training of talents. Therefore, enterprises should pay more attention to the training mechanism of logistics talents. Only in this way can enterprises gradually improve their logistics quality and form their unique competitiveness.

(4) Implement PDCA cycle in total quality management. PDCA cycle is the basic working method of total quality management, also known as Deming cycle. The PDCA cycle consists of four stages: First, plan (P). Plan according to the promises made to customers and principles and policies of the enterprise, as well as through the analysis of key problems, formulate the corresponding solutions and enterprise objectives and logistics quality objectives. Second, do (D). According to the

requirements of the planning stage, the implementation of the whole process is mainly to control the operation quality of the planning stage. Third, check (C). Monitor and measure the whole process, analyze and dispose of the places that do not meet the standards, and analyze the data. Fourth, act (A). This is the summary of the whole cycle, which includes taking corrective and preventive measures for work that does not meet the standards. It also includes managing and reviewing the quality of the whole process of logistics activities, formulating new quality objectives and standard systems for links that do not meet regulations, and then enters into the next cycle of continuous improvement.

However, the current research is more inclined to qualitative analysis, and this study will reflect the TQM theory from a quantitative point of view, and apply the PDCA cycle to the comparative study before and after the application of indexes.

3.2 Lean Management

Lean management comes from Toyota mode of production in Japan, which is a set of brand-new management theory put forward by western scholars who summarize the concept, idea and technical system of Toyota mode of production. Today, both the United States, Europe and other developed countries, or China and other Asian developing countries are studying Toyota mode of production, which are emulated and promoted by enterprises. Lean management is a management idea that enables enterprises and other related subjects to use less resource investment, shorter time while achieving higher work quality and obtaining more benefits through delicacy management, simplified management, benefit management and gradual management.

3.2.1 Lean Production Theory

Lean production, referred to as Lean, is a management philosophy derived from Toyota mode of production. Many well-known manufacturing enterprises and MIT professors in global research, applied and developed Toyota mode of production, and promoted the emergence of lean production theory and production management system, causing the system still to be in the process of evolution. From focusing on the improvement of production site (Kaizen) in the past to inventory control, production planning management, process reengineering, cost management, employee literacy development, supply chain collaborative optimization, product life cycle

management (product concept design, product development, production line design, workbench design, and operation method design and improvement), quality management, equipment resources and human resource management, market development and sales management, many aspects are involved in enterprise operation and management.

Lean production believes that the waste of production is caused by having to repair substandard products. The repair of nonconforming products not only increases the waste of labor, equipment and space, but also leads to the risk of secondary defects in the process of repair. The real causes of non-conforming products are caused by original design, process design, tooling and mould, equipment capacity and process control. It is necessary to improve the quality level of products by optimizing design, process, tooling and mould, improving equipment capacity and increasing the reliability of process control, and finally moving towards the goal of zero defects. Moreover, the waste of resources is caused by retaining a large amount of non-essential inventory, which comes from multiple sources. They are manifested as the low one-time pass rate of products, the current delivery cycle fails to meet the delivery needs of customers, overproduction due to the pursuit of the maximum capacity of expensive critical equipment or bottleneck equipment, and the minimum economic batch production quantity caused by excessive switching time is greater than the real needs of customers. It is necessary to improve one-time pass rate of the product, shorten the delivery cycle, produce the critical or bottleneck equipment on demand and shorten the switching time to reduce or even cancel the production quantity of the minimum economic batch. Simply increasing a large amount of inventory to deal with problems will not only lead to a large amount of capital occupation, but also need to increase a large number of warehousing space and configure the corresponding warehouse management. It is particularly important that high inventory masks the real problems in the process.

Therefore, only by reducing the number of inventory to expose all the real causes of high inventory can we formulate corrective and preventive measures to fundamentally seek ways to reduce inventory. Products and inventory not only represent parts, semi-finished products and finished products, but also include the related work of the support department and the service department.

The essence of lean production is:

First, only at the right time, the production of products that meet customer

requirements is the just-in-time production of JIT (Just in time). Just-in-time production is one of the two pillars of lean production. Through market-oriented and Kanban pull, balanced production can be implemented to avoid premature or excessive production. At the same time, the management of zero defects in the process needs to be focused.

Second, all employees are quality inspectors in the whole process, and the equipment should also have the ability to give abnormal automatic alarm, which is automation (JIDOKA). JIDOKA is also one of the two pillars of lean production, which requires intelligent equipment to help find problems on the spot, send alarm signals and automatically stop work, and remind relevant personnel to go to the site to solve the problem. The equipment will automatically perform the observation actions that people have been performing on the site before, releasing human resources from simple and repetitive actions, and sends a clear signal that human resources are far more valuable corporate property than equipment in the enterprise. Finally, the machine has its own intelligent ability to identify problems and avoid producing non-conforming products after problems occur.

3.2.2 Lean Management Theory

Lean Management originates from Lean Production. The core idea of lean management is to regard non-value-added activities as waste, and summarizes eight kinds of waste in production, which are collectively called DOWNTIME, as shown in Table 3-2. For a long time, people have focused on improving the efficiency of value-added activities, while neglecting to tap the potential of non-value-added activities. Research shows that from entering the factory to leaving the factory, only 10% of the time is used to add value to the product. The secret to the success of lean management is to shift the focus of efficiency to non-value-added activities that account for 90% of the time.

Table 3-2 Eight Wastes

NO.	Waste category	Description	Reason	Improvement methods and tools
1	Defects Waste of substandard and repairs	Waste of substandard and repairs	-Unreasonable processing procedures. -The process is unstable and there are too many variations in the process.	-Improve the process and improve the process capability. -Lean tool: Poka-yoke error prevention method
2	Overproduction	The products	-Without considering the production	-Reduce conversion setup time.

	Waste of excessive production	produced are superfluous or earlier than the needs of internal and external customers.	capacity of the downstream process, we just want to complete the work that is responsible for this process as soon as possible. -Uneven production capacity, resulting in excess capacity. -Afraid of defective products. -Worry about machine failure. -Employees may be absent. -Use expensive equipment effectively and don't stop it.	-Synchronize the processes to produce the required quantity of products only at the right time. -Lean tools; quick mold change, Kanban system, pull production.
3	Waitting Waste of waiting	Due to material breakage, uneven work, improper planning, and the waste that the operator has nothing to do (or just monitor) while the machine is running.	-Uneven production line, material shortage, machine failure. -The staff are there to monitor the operation of the machine. -Employees wait for the next work piece to arrive.	-Optimize man-machine operation. -Synchronize processes and balance logistics and workloads with flexible staff and equipment. -Lean tools; multi-skilled jobs.
4	Non-utilized people Unused employee creativity	Failure to make employees participate or fail to listen to employees' opinions, and employees' autonomy and creativity are not high.	-The other seven wastes, especially inventory, cover up many problems and fail to force team members to think fully. -There is no atmosphere of full participation and continuous improvement.	-Reduce the remaining seven major wastes, especially inventory waste, fully expose problems and force people to think about countermeasures. -Promote full participation and continuous improvement, such as the establishment of learning organizations. -Lean tool: Kaizen.
5	Transportation Waste of Transportation	Handling is a kind of non-value-added action, and the handling loss can be divided into: placing, stacking, moving and finishing.	-Unreasonable production layout and long distance between processes	-Establish smooth and uninterrupted continuous production. -Optimize production layout. -Lean tools: unit production line, OPF single piece flow.
6	Inventory Waste of Inventory	For inventory, including finished products, raw materials and intermediate work-in-process, the larger the inventory,	-Excessive safety inventory. -Changeable purchasing cycle.	-Reduce conversion setup time. -Synchronize the processes to produce the required quantity of products only at the right time. -Reduce safety inventory. -Lean tools: Kanban system, pull production.

		the greater the backlog of funds, the increase in handling volume, the decline in the value of goods, the occupation of space, and the cover-up of various problems.		
7	Motion Waste of Motion	A waste of time caused by unreasonable homework actions	-Repeat operation. -Inappropriate layout of workstations.	-Study and improve the consistency and economy of movements. -Improve the action before mechanizing or automating the action. -Reduce safety inventory. -Lean tools: standardization of homework.
8	Extra processing Waste of Extra processing	Unrequired, superfluous or excessively precise processing by the customer	-Too strict quality control.	-First of all, study whether it is necessary to do it. -Re-examine why you want to do this. -Lean tools: ask why 5 times.

Source: Wu Di. Lean Production [M]. Tsinghua University Press, 2016:35-36.

With the fierce competition among enterprises, the traditional era of high profits no longer exists, which is followed by the current era of low profits. Therefore, lean production mode has been fully carried out in enterprise management, and lean management came into being. Lean management applies the lean theory to all fields of the enterprise, deletes all unnecessary links and eliminates the waste of non-value-added in all links. Its core idea is to create the maximum value with the minimum investment of resources to provide quality products and services to ensure maximum customer satisfaction. With the continuous development and maturity of lean management, the traditional lean production system has gradually evolved into a generalized lean management system, as shown in figure 2-2.

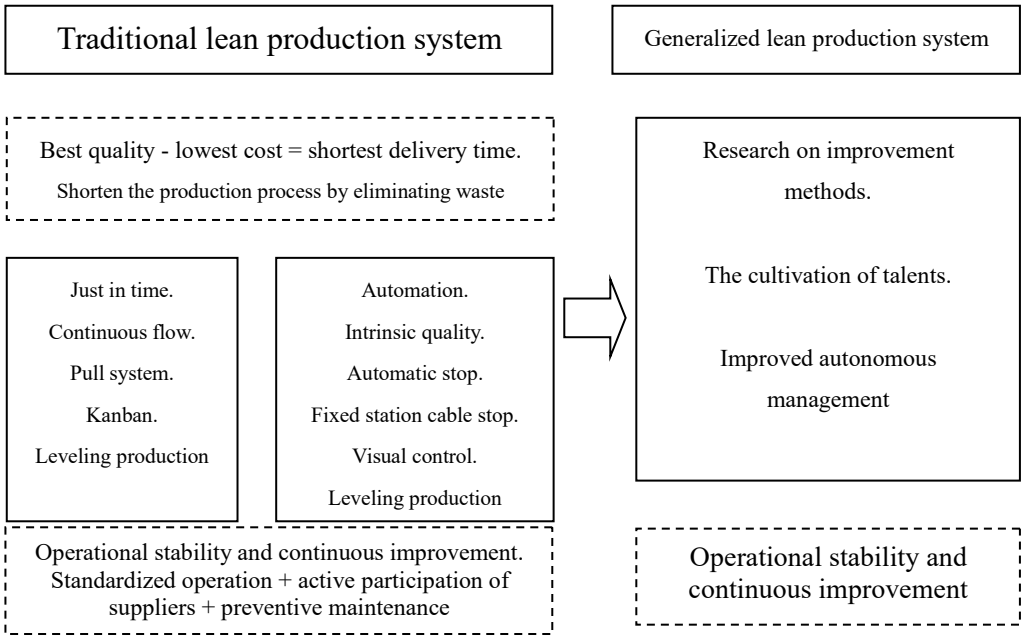

Figure 3-2 Traditional Lean Production System and Generalized Lean Management System

Source: Wu Di. Lean Production [M]. Tsinghua University Press, 2016:116.

3.2.3 Lean Thinking Theory

Lean Thinking sums up the new management thinking contained in lean production from the perspective of theory, and expands the lean way to all fields (excluding the manufacturing industry), especially the tertiary industry. The lean production method is extended to all aspects of enterprise activities, which is no longer limited to the field of production, thus prompting managers to rethink the business process, eliminate waste and create value. Lean thinking provides a way to help define values and arrange productive value activities in the best order, and to make them more effective by implementing them without interference (no matter who interferes). Lean thinking converts waste into value through timely feedback, making work more satisfactory. Moreover, the current popular practice of process re-engineering cut staff under the banner of improving efficiency, thus seriously affecting the enthusiasm of all staff to participate. By contrast, Lean thinking provides a way to create new jobs to motivate employees.

The five principles of lean thinking are:

(1) Accurate definition of the value of products. First, we are clear that customer recognition proves the value of enterprise products and services. Only the products that customers need have value, and the rest are just inventory, or are about to become sluggish inventory. This correct lean value unifies the interests of suppliers,

production enterprises, dealers and end customers and other relevant parties in order to achieve win-win results. If we use lean thinking to review the whole production process of an enterprise, we will find that there is too much waste, thus creating the urge to eliminate waste.

(2) Identify the value stream of each product. Value stream refers to all activities in which the enterprise is given value in the realization process from raw material to finished product, including value-added and non-value-added activities. To identify the meaning of the value stream is to adhere to lean idea to find out the value-added and non-value-added activities in the value stream.

(3) Make the value flow continuously. Lean thinking holds that all stagnation in the production process is unnecessary waste and advocates using continuous improvement, just-in-time production, one-piece flow and other lean management methods to create the continuous flow of value as much as possible in the case of arbitrary batch production.

(4) Let the customer pull the value from the producer side. Lean thinking holds that using the pull principle, enterprise can eliminate the premature and excessive investment, the appropriate amount of production, reduce excessive inventory and on-site work-in-process, and eliminate waste.

(5) Always pursue perfection, which has three meanings, including endless continuous improvement, continuous improvement of customer satisfaction and conducting valuable activities. Continuous attention to perfection in these three aspects can help enterprises increase their competitiveness and the ultimate goal of lean manufacturing is to provide users with perfect value through a perfect value creation process.

The core of lean thinking is people-oriented, emphasizing that employees are the most valuable resources of enterprise and the cornerstone of sustainable development. The correct application of lean thinking has many advantages, such as improving the management of employee relations to enhance the sense of teamwork, through effective training and establishing a reasonable incentive mechanism to improve the utilization of human resources, increase employees' loyalty to enterprise, stimulate employees' initiative creativity and reduce the waste of suggestions on the effectiveness of human resources and innovative improvement suggestions by building a lean culture with enterprise characteristics. Applying lean thinking to enterprise employee management, setting up an employee relationship management

system based on lean thinking, applying principles of lean thinking to establish lean human resource management and striving to minimize the waste of human resources according to the development of the enterprise itself is conducive to helping enterprises achieve the goal of creating more value.

3.2.4 The Application of This Theory in Study(BJ Company)

Lean logistics is a logistics method based on lean thinking. That is to reduce waste to a minimum while providing satisfactory customer service. The basic principles are:

(1) Study what can generate value from the point of view of the customer rather than the enterprise or functional department.

(2) Determine the necessary steps and activities for the supply, production and distribution of products according to the needs of the entire value stream.

(3) Create a value-added activity flow with no interruption, no detour, no waiting and no back-flow.

(4) Create value driven only by customers in a timely manner.

(5) Constantly eliminate waste and pursue perfection.

The two most fundamental indexes of logistics management are to improve the service level and reduce cost. Logistics service quality evaluation can provide management objectives and guidance for enterprise management, especially the assessment of economy, environmental protection and greenness. Evaluation indexes should be set up with lean thinking, to achieve overall cost reduction, effective use of resources and environment-friendly on a comprehensive and systematic basis.

Lean logistics has the following characteristics: closely circling around customer demand, taking customer demand as market guidance, and making a reasonable analysis of product design and manufacturing in the value chain to find the mitigation of waste that cannot provide value addition. To work out a value-creating action plan based on the principles of uninterrupted, non-circuitous and non-retrograde. Once a wasteful link is found, it will be perfected in time. The management of lean logistics supply chain has an important impact on the operation of the whole enterprise, which is related to the operation and market share of enterprise, but many companies still have deficiencies in this respect, including improper management of materials, imperfect warehousing system and low efficiency of distribution. If enterprises want

to strengthen the management level of lean logistics supply chain, the first task is to find out the problem and improve it continuously.

In this research, the management idea of lean logistics is applied to the construction of quality evaluation index, and the idea is quantified, which is helpful to improve the performance level of BJ logistics supply chain.

3.3 SCOR Model

3.3.1 The Origin of SCOR Model

With the emergence of the new management concept of supply chain management and the confusion of supply chain management in major enterprises, mainly two American consulting firms, PRTM (now acquired by PwC) and AMR (now acquired by Gartner), together with other leading companies in the United States, announced the establishment of Supply-Chain Council in 1996. At the end of that year, the first version of SCOR (Supply-Chain Operations Reference Model) was released to help enterprises achieve supply chain management.

As an independent international non-profit organization, SCC now has more than 1000 member units in eight regions around the world after more than 30 years of development, including not only production, service, distribution, retail and other conventional fields, but also technical service companies, business consulting companies, academic institutions and government agencies. As the first and most well-known supply chain management model, SCOR has been constantly revised in practice in various fields, and now the latest version is 12.0.

According to SCOR description, it provides a standard framework for enterprise supply chain management that connects performance evaluation, process re-engineering, best performance and executor's ability, becoming a global supply chain management language. Through the comparison of performance measurement and best performance, it evolves the current process state from as-is to to-be in designing the future process state. At the same time, as a supply chain diagnosis tool, after reasonable application, it aims to continuously solve the five major challenges of the supply chain: Superior Customer Service, Cost Control, Planning and Risk Management, Supply/Partner Relationship Management, and Manager Talent.

3.3.2 How to Use SCOR Model

When in use, SCOR model first divides the whole supply chain into five processes: Plan, Source, Make, Deliver, and Return. Suratin Tunyaplin et al. (2021) used SCOR model to analyze how to improve the performance of the last kilometer in DIY furniture industry. Philip Kofi Alimo (2021) pointed out that the use of SCOR model can reduce losses in the vegetable and fruit industry, thus reducing costs.

(1) Plan: including the collection of customer demand and shipable goods information, and the action plan arrangement to balance demand and production as the beginning of company's business to serve the other four processes.

(2) Source: the process of obtaining materials by order production or planned production.

(3) Make: the process of organizing raw materials for production or organizing services according to different requirements.

(4) Deliver: the process of fulfilling customer orders, such as warehousing, selection, packaging, logistics and distribution, and invoicing, after the completion of production as planned.

(5) Return: the process in which the product is returned from the customer to the enterprise and returned to the supplier by the enterprise for various reasons, including repair and recycling.

These five processes cover the working process of a modern single enterprise or multiple enterprises in the supply chain. The delivery of an enterprise is procurement to its downstream enterprises, while the return link involves multiple enterprises. At the same time, as a standard framework, SCOR refines the business of the enterprise into five processes, and makes a good definition of the boundaries between enterprises in different types of supply chain, which is easy to communicate.

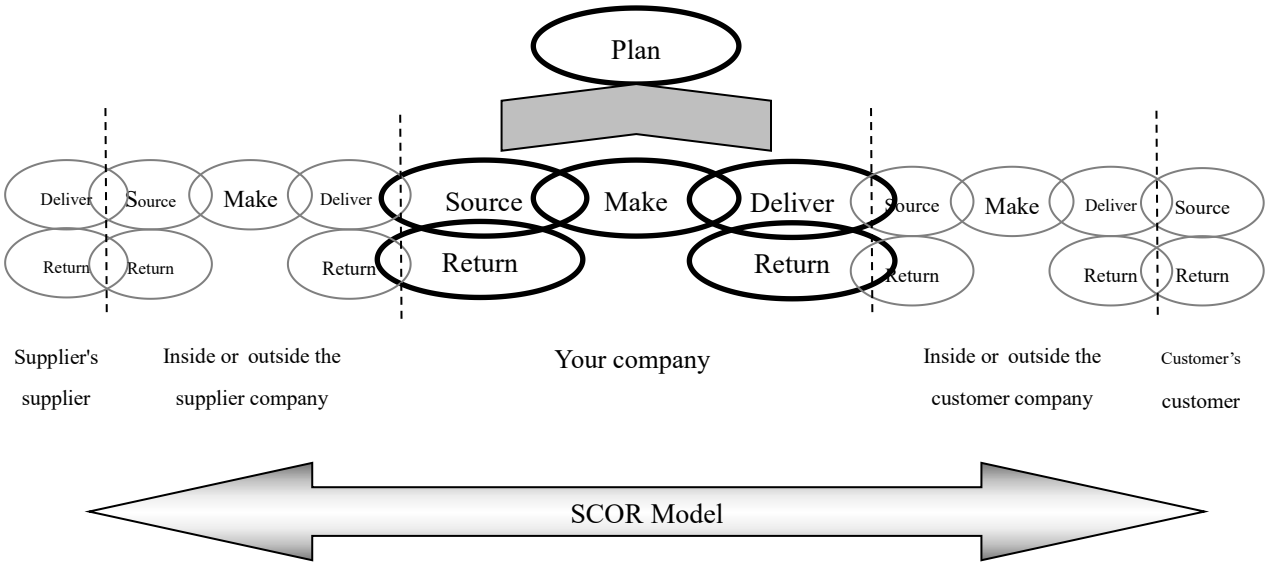

Figure 3-5 The SCOR Model is organized according to Five Basic Management Processes
Source: Liu Yumei, Xu Zhangyi. Construction of supply chain operation model of automobile manufacturing enterprise based on SCOR [J]. Logistics Technology, 2008. 27 (4)

Secondly, the SCOR standard model includes three levels vertically:

Layer 1: define the project scope of the supply chain, the number of supply chains and the way to measure performance. That is, to make a framework for the supply chain management to be optimized. Through the omni-directional analysis of the background, products, geographical location, internal and external situation, operation mode and other aspects of the supply chain enterprise, it is concluded that the project scope and the number of supply chain need to be optimized as the optimization object, and the way of performance measurement is defined.

In the SCOR model, performance measurement standards are divided into five categories, which reflect the flexibility, responsiveness and flexibility of supply chain efficiency indexes, as well as costs and benefits that reflect supply chain financial indexes. These five categories of indexes continue to be refined into a total of 13 items, such as perfect order fulfillment rate, order fulfillment cycle, supply chain upward flexibility, supply chain management cost, and cash flow cycle. At the same time, SCOR also provides optional calculation formulas. These indexes can be further divided according to different sub-processes, the more detailed the subdivision is, the higher the possibility of implementation is, and the clearer the supply chain performance reflected is. Combined with the best performance-data benchmarking analysis, we can find out weak links and a more accurate direction for optimization.

In the corresponding data benchmarking analysis, SCC conducted a benchmarking survey of supply chain management performance scorecard, which so far has been joined by more than 800 enterprises, including Intel and IBM. The SCOR model gives the gap between the current index and the target level, the general level of the industry and the best level of the industry in the form of scorecard, which is more referential.

According to the performance evaluation standard framework of SCOR model, Liu Songbo and Wang Haibo (2004) believe that in the traditional assessment mechanism, the assessment based on departmental responsibility artificially separates the process, thus forming a state of departmentalism with a large number of stakeholders, and excessive specialization also leads to the increase of internal transaction costs and communication costs. SCOR performance management, which is process-oriented, changes departmental assessment to process assessment to break through the boundaries between departments, which is different from DuPont analysis focusing on financial profit assessment, and is also different from the comprehensive assessment centered on strategy in the balanced scorecard. SCOR performance evaluation embodies a new idea with process as the core and a broader vision of horizontal integration, which is a very important part of the model.

Layer 2: define planning and execution policies using standard configuration categories. That is, the executive configuration layer under the five processes is defined. SCOR provides 26 core configuration processes, as shown in Table 3-3:

Table 3-3 SCOR Core Flow Chart

Plan	P1 plan supply chain P2 plan purchase P3 plan production P4 plan delivery P5 plan return
Source	S1 purchase inventory products S2 purchase order production products S3 purchase order customized products
Make	M1 inventory production M2 order production M3 order customization
Deliver	D1 distribution inventory products D2 distribution orders production products

	D3 distribution orders customized products D4 distribution retail products
Return	SR1 defective raw materials return SR2 maintenance raw materials return SR3 excess raw materials return DR1 defective product return DR2 maintenance product return DR3 excess product return
Empower	EP support Plan ES support Purchasing EM support production ED support delivery ER support return

Source: Liu Yumei, Xu Zhangyi. Construction of supply chain operation model of automobile manufacturing enterprise based on SCOR [J]. Logistics Technology, 2008. 27 (4)

In these core processes, each enterprise can make a choice according to the actual situation and build its own configuration flowchart. At the same time, the 26 core processes include not only the five processes mentioned above, but also the Enable process, which is meant to support the activities that enable each process function to be realized. At present, SCOR defines nine supporting elements, namely E1 regulation establishment and management, E2 performance evaluation, E3 information system and data management, E4 inventory management, E5 asset management, E6 transportation management, E7 supply chain network management, E8 compliance management and E9 special elements. The enabling process of each large process is composed of these nine supporting elements, such as EP.1 supports the regulation establishment and management in the plan. The special elements are independently defined according to the business characteristics of enterprise. Although these supporting elements do not play a role in cargo logistics, information flow and financial flow in the business process, as the embodiment of the implementation of business process management functions, serve as the guarantee for the smooth progress of business process.

Layer 3: the process element layer, which defines the business processes and system functions that are processed by the configuration execution layer, that is, the functions of the execution layer continue to be refined and dispersed into each

sub-process. Among the 21 core processes except 5 enabling processes, each configuration process layer contains a number of process elements with logical relationships. By defining the input and output information of each process element, the whole process business can be fully displayed.

After Layer 3, if necessary, we can continue to carry out Layer 4 and Layer 5 to define the necessary details of the implementation management process and the specific software configuration. However, the subdivision level after Layer 3 no longer belongs to the SCOR model, but the specific refinement measures determined by the enterprise itself according to strategic needs. At the same time, the performance criteria contained in Layer 1 can also be used as the performance standards of Layer 2 and 3 of the process, a complete supply chain model, which not only contains a complete pyramid process, but also performance standards in each level. Through the quantified standards to check and make up for gaps, the problem is found.

3.3.3 A Summary of Research on the Application of SCOR

It has been more than 20 years since the introduction of the SCOR model. From the introduction of the initial theoretical framework to the guidance of enterprises to optimize the operation, foreign enterprises have gradually matured in the use of the model. In recent years, many foreign branches in China have begun to use SCOR to guide supply chain optimization in China according to their foreign experience, and domestic enterprises have gradually begun to pay attention to SCOR.

The research on the application of SCOR model is mostly based on the construction and research of process element diagram combined with the actual business process of the enterprise. Chen Bo and Shi Deliang (2010) built Layer 1, Layer 2 and example Layer 3 of the shipbuilding supply chain based on the SCOR model, and rebuilt the performance index system according to the specific conditions of the shipyard, extending the performance indexes to the process elements of Layer 3. Xu Xuanguo, Liu Fei and Wang Yunfei (2013) used SCOR to build the production logistics model of manufacturing enterprises. First of all, the manufacturing process of the sample product is decomposed, on the basis of which it is more reasonable to build a three-layer model of SCOR. According to the production process of Moutai, Gao Bo (2016) clearly expounded the process layer, configuration layer, process element layer and enterprise-specific business process layer of Kweichow Moutai, and built the SCOR supply chain model of Kweichow Moutai, which is of great

significance for enterprises.

In many applied studies, Peter Polstiff's book *Supply Chain Excellence* (2015) is regarded as a textbook SCOR model practice manual. He takes Fusler as a case, starts from building organizational support to defining project scope, then lists the refinement of the project portfolio through performance analysis and defect analysis, and finally implements, forming a complete supply chain optimization process.

3.3.4 A Summary of SCOR Risk Management Research

If SCOR is viewed as a supply chain management model, risk management studies based on it are not small in number. In terms of supply chain risk classification and identification, Liu Zhengyun (2009) divided supply chain risk into planning risk, fund-raising risk, reserve risk, supply risk and recovery risk with reference to the definition of the basic process of supply chain by SCOR model. At the same time, the risks of each process are listed in detail: planning risk includes the risk possibility in the formulation of material demand plan and the transmission of demand information. Financing risk includes the risk possibility of material price fluctuation, international exchange rate fluctuation and supplier selection. Reserve risk includes the external environment and the risk possibility caused by poor management. Supply process risk includes the risk possibility caused by the immature technical ability, operation ability and coordination ability, while risk of the recovery process includes the risk possibility caused by the failure of product quality and service quality. Yang Yang, He Ziwei (2015) and Wang Miaomiao (2016) enumerated and analyzed the supply chain risks of new energy vehicles and pulp and paper industries in the five processes of planning, procurement, production, distribution and return respectively. Combined with enterprise characteristics, it is enumerated and analyzed, providing a reference for risk event identification based on SCOR model.

In terms of risk management and control, Ma Lin combines five processes in the SCOR model with risk management methods and techniques, and puts forward a model-based risk management framework, as shown in figure 2-6.

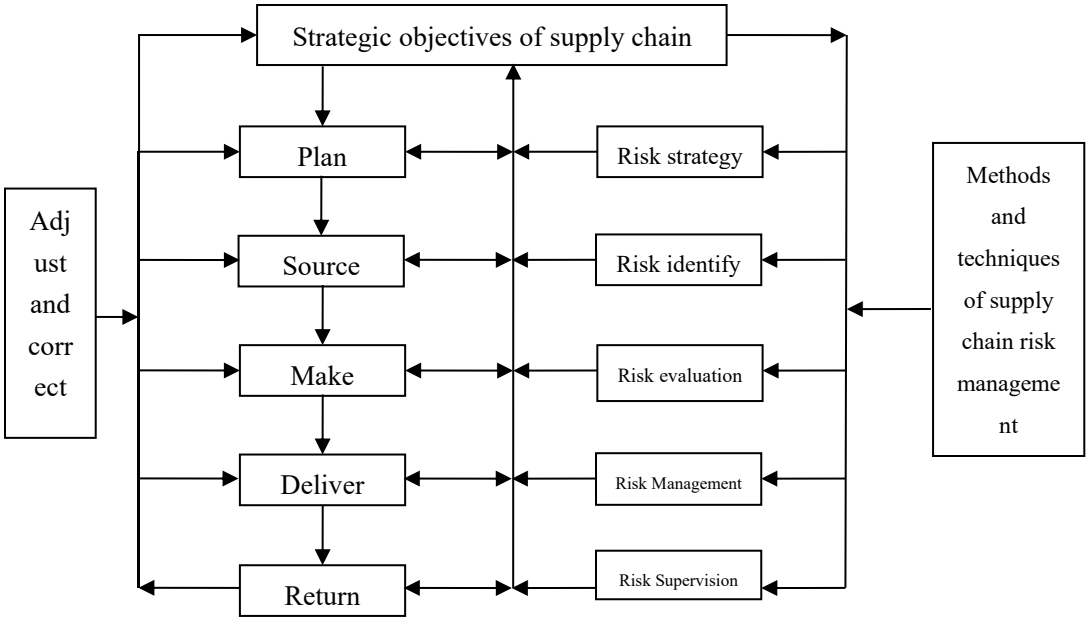

Figure 3-6 Supply Chain Risk Management Framework based on SCOR

Source: Ma Lin's, Research on Integrated Supply Chain Risk Management based on SCOR Model, Business Research, No. 6, 2008

At the same time, Ma Lin believes that traditionally, different types of risk analysis in the supply chain are carried out by different people from different enterprises and departments with different methods, and there is little communication and cooperation between them. This separation is the main disadvantage of supply chain risk management. Based on this, he proposed an integrated supply chain risk management model based on SCOR model, which organically combines supply chain risk management objectives, culture, organization, process and information system, and forms a management structure as shown in figure 3-7.

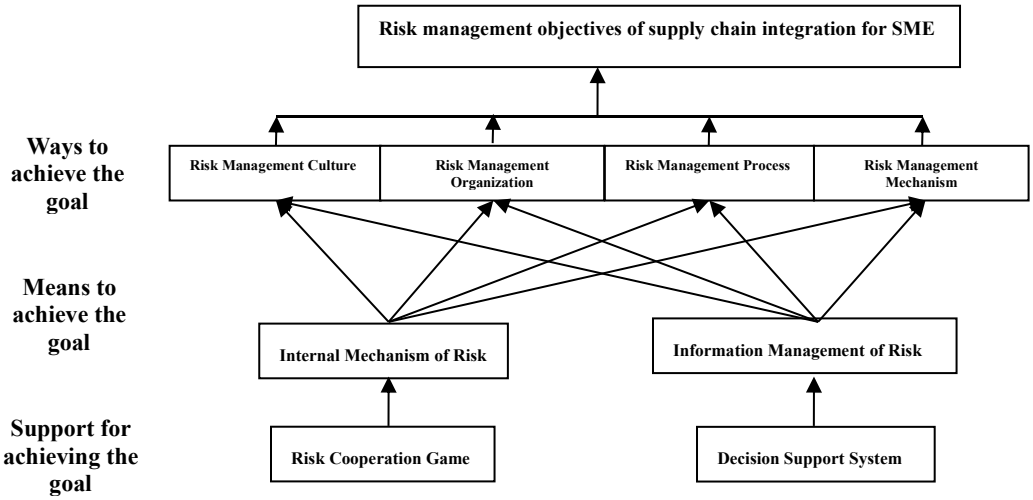

Figure 3-7 Integrated Supply Chain Risk Management Architecture

Source: Ma Lin, Research on Integrated Supply Chain Risk Management based on SCOR Model, Business Research, No. 6, 2008

The management framework is well organized. First is the construction of initial risk cooperation game conditions, which determine the risk control measures. Setting up a quantitative decision support system is conducive to the management of risk information, and the risk identification and assessment are completed from the side. After that, the goal of risk management can be achieved through risk management culture, risk management organization, risk management process and risk control mechanism.

~~In a word,~~ the traditional supply chain risk management research considers the supply chain as a whole and focuses on the overall risk in the classification and identification of the supply chain. On the contrary, the research on supply chain risk management based on SCOR model depends on the existing model framework, starts from the five major processes, and pays more attention to the controllable risks existing in the supply chain in risk classification, identification and management, which is more operable for supply chain enterprises.

3.3.5 The Application of This Theory in Study (BJ Company)

The two most important aspects of the SCOR model are: first, the three-layer process framework provided. Many enterprises can use this framework to classify business conditions and draw processes, quickly clarify and improve the process and even expand to Layer 4 and Layer 5, and the second is a perfect supply chain performance evaluation framework, which provides practical data support for supply chain problem analysis, and determines the goal and direction for supply chain optimization. Combined with the results of performance evaluation, the supply chain problems are analyzed and solved. At the same time, the academic research on SCOR model has never stopped. Huang Peiqing, Zhang Cunlu and Jiehui (2004) believe that SCOR model applies standard terms and symbols, provides a convenient description tool and ideological method, combines specific operations with performance measurement indexes, achieves quantitative analysis of the operation performance of the whole supply chain, and provides a rapid modeling method, serving as a powerful tool for supply chain design and reengineering. According to Li Gaopeng (2004), the basic concept of SCOR supply chain operation reference model comes from three

aspects: business process reengineering analysis, benchmarking management, and best practice analysis, which basically covers all links of the product threshold circulation, providing not only a modeling tool to identify and define the supply chain business process, and a set of analysis procedures and framework for enterprises, but also serving as a supply chain diagnosis tool. The release of best practices and indexes, as the goal of supply chain transformation, is a great development of the application of supply chain management theory.

In addition to above advantages, the limitation of SCOR model is that it belongs to the macro model, which is suitable for the improvement of the whole supply chain, and fails to analyze a certain link of the supply chain. At the same time, after quantitative performance evaluation is used to reflect the real problems of the supply chain, great changes will be made from top to bottom in the real implementation. Therefore in actual use, we should first build organizational support and set up a high-level group. Otherwise, it will not be implemented because there is resistance to change.

Because of the maturity and applicability of SCOR for most enterprises, this thesis chooses to use it as a starting point to complete the exploration of the combination of supply chain management theory and the actual business of iron and steel logistics, and uses the perspective of supply chain to analyze and solve the problems of iron and steel logistics business. At the same time, the focus of the use of SCOR model is to analyze the problem and study the optimization scheme with the help of its mature system, so the limitations in the implementation has little impact on the research.

3.4 Green Assessment of Logistics Industry

3.4.1 A Summary of Research Methods of Logistics Green Efficiency

The green development of logistics industry meets the needs of current development. Different scholars study green logistics from different perspectives. The most widely used at home and abroad is the carbon intensity index based on the framework of single factor productivity. Sun (2003) believed that carbon intensity was an ideal index to study carbon emission reduction. Chen Jie (2014) measured and analyzed the green efficiency of China's logistics industry by using the panel data of China's logistics industry from 2004 to 2011. Combining the carbon intensity index,

she suggested that we should rely on technological progress and innovation to improve green efficiency of the logistics industry. Zhang Cheng et al. (2014) selected two indexes of carbon intensity and energy intensity to study the development of green logistics in China, and proposed that China's logistics industry save energy and reduce emissions, optimize energy structure, and strive to achieve the 13th Five-year Plan Emission Reduction Target. Gao Xin (2016) chose carbon intensity as an index to study that the introduction of FDI in China can reduce carbon dioxide emissions of the logistics industry, to achieve energy saving and emission reduction, and improve green efficiency of the logistics industry. Based on the co-integration analysis, Wang Fuzhong (2018) concluded that there was a co-integration relationship between the carbon intensity of the logistics industry, energy prices and goods turnover, and suggested that government should improve the transportation network and guide the industrial upgrading of the logistics industry scientifically and rationally to realize the green development of the logistics industry.

Carbon intensity index is easy to use and analyze, but there are many shortcomings at the same time. First, the selection of carbon intensity as an index fails to take into account the technical capital invested in the production process. Second, carbon intensity does not reflect the technological gap. Third, carbon intensity indexes often ignore changes in carbon emissions. Due to the above shortcomings of carbon intensity, some scholars try to combine carbon intensity with other productivity indexes, but still cannot eliminate the disadvantages of carbon intensity indexes. Under this background, scholars have developed an index analysis system based on all-factor framework.

DEA is a multi-input and multi-output index analysis method, and is also one of the most frequently used methods to measure efficiency. Its core idea is to construct the production frontier curve according to the actual sample points, and then use the distance function to define the efficiency by the relative distance between different sample points and the production frontier curve. Because this method is not limited by the form of function, its application is more flexible, and it can take into account the actual production process. At present, scholars often use DEA as a multi-factor index to measure green efficiency of the logistics industry. Zhou Yewang (2012) used DEA model to measure the actual green efficiency level of logistics industry in all provinces and cities in Wuhan metropolitan area, and put forward improvement measures combined with the research results. Liu Jie (2013) used Data Envelopment

Analysis (DEA) and Analytic Hierarchy Process (AHP) to take Changchun Eurasia Group as an example to measure the efficiency of logistics distribution and design the best logistics distribution model. Meng Xin (2015) selected DEA-CCR and DEA-BCC models to deeply analyze the logistics efficiency of the Yangtze River Economic Belt from 2009 to 2013, further decomposed the total efficiency into pure technical efficiency and scale efficiency, made a more in-depth analysis of logistics efficiency, and put forward improvement and optimization countermeasures according to the measurement results. Zhou Ye (2015), on the basis of the provincial logistics industry panel data from 2006 to 2011, used super-efficiency DEA analysis method to measure the green efficiency of logistics industry in all provinces of China, and through the frontier analysis of green efficiency to find the corresponding areas where the resource input is too high, and to analyze the reasons that affect the green efficiency of logistics industry in these provinces. The results show that the green efficiency of the logistics industry in the eastern region is higher than that in the western region. Sun Jian (2016) used the DEA model to measure and analyze the cold chain logistics efficiency of agricultural products in Northeast China, innovatively considered the cooperation factors, and put forward suggestions to promote the sustainable development of agricultural products cold chain. Guo Mengya (2017) , on the basis of the panel data of Guangdong Province from 2001 to 2014, combined DEA research method, studied and analyzed the green logistics efficiency of Guangdong Province as a whole and all its prefecture-level cities. The results show that the overall efficiency of Guangdong Province fluctuates greatly, while the green efficiency of logistics industry in prefecture-level cities fluctuates less and remains in the process of benign development.

3.4.2 Research on the Relationship between Green Development and Economic Development of Logistics Industry

At present, the relationship between green development and economic development of logistics industry begins to appear in a large number of literature. Domestic and foreign scholars often use energy consumption to study the relationship between green development and economic development of the logistics industry. For example, Wang Xiaoye and Hong Guobin (2007) used panel data from 1953 to 2004 and adopted cointegration analysis technology, Granger causality test and other methods, studied the development of China's logistics industry, with the result

showing that the development of China's logistics industry significantly promotes the development of economy. Lei Xuanping et al. (2008) used regression analysis to explore the relationship among logistics industry, energy consumption and economic growth based on the data of Anhui Province from 1991 to 2005. According to the empirical results, it is predicted that the green development of the logistics industry will be an important part of revitalizing the economic development of Anhui. Yang Zhiliang et al. (2009) used the causality test to study the relationship between energy consumption and economic growth in the logistics industry from 1991 to 2007. Li Hong et al. (2012) studied the relationship between energy consumption, carbon emissions and economic growth in the transportation industry. It is found that the impact of the former on the latter increases at first and then decreases, and tends to be stable for a long time. The contribution of the former to the prediction variance of the latter decreases at first and then increases due to the influence of structural adjustment. Yang Liangjie et al. (2014) extended the KAYA identity and used LMDI decomposition method and Tapio model to study the relationship between energy consumption and economic development of transportation industry in Jiangsu Province from 1995 to 2010. It is found that the decisive factor driving the growth of energy consumption of transportation industry in Jiangsu Province is the expansion of economic output scale. Wang Fuzhong (2015) established the cointegration equation and studied the relationship between logistics industry and economic development through Granger causality test. Cao Cuizhen et al. (2015) studied the relationship between logistics industry and economic growth based on the data of various provinces in China from 1999 to 2013. The results show that the intensity of energy consumption in China is inversely proportional to the development level of logistics industry, and the development of logistics industry is directly proportional to economic growth. Sungwon Lee et al. (2015) studied the relationship between the change of car ownership and energy consumption in South Korea from perspectives of economic growth and fuel price fluctuation.

3.4.3 Research on the Environmental Effect of Green Efficiency of Logistics Industry

Scholars in the study of the green development of the logistics industry only considered economic factors while ignored the constraints of the environment, so they cannot accurately evaluate the level of green development of the logistics industry, nor can they truly reflect the operation of economy. Since then, scholars have taken

environmental factors into consideration when studying the green development of the logistics industry, and there are more literature about carbon dioxide emissions and industry development of the logistics industry. In the study of the green efficiency of the logistics industry, environmental factors, generally consider pollutants-carbon dioxide are considered. According to Chen Shiyi (2009), domestic and foreign scholars put carbon dioxide emissions and other factors into the logistics industry green efficiency out of two main ideas: one is the carbon dioxide variable as an input (such as Atakelty Hailu, 2001; Chen Shiyi, 2009; Li Shengwen et al., 2010; Du Kerui and Zou Chu Ruan, 2011). The use of carbon dioxide as intermediate input can reduce the unexpected output as much as possible, but it does not conform to the actual production process. For example, Zhang Liguo (2015) uses carbon dioxide as an unexpected output to study the green development of China's logistics industry from national and regional perspectives. It is found that the average carbon dioxide emission efficiency index of China's logistics industry has been improved to a certain extent, showing that the east is better than the middle, and the middle is better than the west. Bao-jun Tang et al. (2014) studied new energy vehicles and analyzed the relationship between the use of new energy vehicles and carbon dioxide emissions. Tang Jianrong et al. (2014) used Tapio decoupling analysis model to analyze the relationship between carbon emissions and the development of logistics industry in eastern China, with the result showing that the two enjoys expansion negative decoupling-strong negative decoupling-expansion negative decoupling from 2004 to 2011. Yang Kaijun et al. (2016) used DEA-SBM model and Global Malmquist-Luenberger index model to investigate the total factor energy efficiency of the logistics industry in the Yangtze River Economic Belt from 2004 to 2013, and concluded that carbon emission constraints will lead to the decline of the total factor energy efficiency of the logistics industry. Mariano E.B. Et al. (2017) put carbon dioxide into the analysis framework, and used DEA-SBM-VRS model, window reference method to construct reference set and Malmquist index decomposition method to evaluate the logistics performance of 104 countries, including CO2 emissions, drawing the conclusion that Japan, Germany, Togo and Benin have the highest performance index. Yu Liying et al. (2018) took CO2 into consideration and used the DEA-Malmquist index model to investigate the logistics efficiency of the Yangtze River economic belt from 2008 to 2015, drawing the conclusion that the logistics efficiency in the middle and upper reaches of the Yangtze River economic

belt lags behind, while that in the lower reaches is good, but with its growth rate slowing down.

3.4.4 Implementation Mechanism and Policy of Green Logistics

In order to implement the concept of green development in all aspects of the logistics system, domestic and foreign scholars put forward relevant countermeasures and suggestions from the macro and micro levels.

(1) Macro-mechanism Level:

From a macro point of view, many scholars put forward views on the healthy and sustainable development of green logistics in China. Ren Zhiyuan (2010) pointed out that the development of green logistics in China needed to speed up the construction of green transportation and storage industry, and encouraged logistics enterprises to develop and innovate green and energy-saving technologies, so as to improve the input-output efficiency of logistics enterprises. Zhou Gowen (2010) compared the current situation of the green development of the logistics industry at home and abroad, considering that reasons that restrict the green development of China's logistics industry include the lack of well-planned logistics parks, the lack of cold chain breakpoints, the lack of advanced technology and excellent logistics personnel. Duan Shengxian and Pu Bei (2014) analyzed problems existing in the development of E-green logistics in Changsha, Zhuzhou and Xiangtan, and put forward the relevant measures to promote the development of green logistics from a macro point of view. First, cultivate the concept of green environmental protection among the public. Second, the government should do a good job in top-level design, reasonably plan the development of green logistics and improve relevant laws and regulations. Third, vigorously promote logistics tax reform. Fourth, clarify the relevant indexes of the logistics industry. Li Yuting (2015) made an in-depth study and comparative analysis of international green logistics policies, and put forward that these policies mainly include high pollution carbon tax, green energy, financial subsidies for green development enterprises, and carbon trading.

(2) Micro-enterprise Level:

In addition to opportunities, the development of green logistics has brought more difficulties and challenges to enterprises. In order to achieve the green development of logistics, enterprises need to reduce carbon dioxide emissions as much as possible in daily logistics operations. Therefore, there is an urgent need to provide enterprises

with a scientific and reasonable carbon emission reduction plan. Alan McKinnon (2008) pointed out that enterprises achieving green logistics can be divided into the following steps: first, rebuild the logistics system; second, reconstruct the supply chain; third, rebuild the distribution system; fourth, goods mode separation; fifth, route design; sixth, asset utilization evaluation; seventh, green efficiency evaluation; eighth, the use of clean energy, especially bio-energy. However, most enterprises have difficulties in implementing these steps proposed by Alan McKinnon. Wang Lepeng (2010) believed that enterprises should be encouraged to establish a logistics public information platform, share the supply and demand information of logistics, and introduce the optimal decision-making model at the same time. Zhou Dejian (2010) believed that delicacy management can effectively promote the green development of enterprise logistics. Enterprises need to clarify management responsibilities, strengthen independent management and improve the management mechanism, and establish a set of scientific, standardized and operational management system in practice, so as to improve the operational efficiency of enterprises and realize the green development of enterprise logistics. Starting from the current situation of the green development of China's logistics industry, Yang Chenchen (2015) believed that enterprises should increase the technological research and development of green logistics in warehousing, circulation and processing, so as to make every link of enterprise logistics business activities in line with green standards. Huang Jia et al. (2018) took New Alto Company as the research object and put forward suggestions for the development of green logistics from a micro point of view-to form the concept of resource sharing. Enterprises should actively share efficient logistics equipment, advanced logistics systems and complete logistics information. Enterprises should also appropriately package products and strengthen recycling and reuse of packaging in order to reduce the production of packaging waste.

3.4.5 The Application of This Theory in Study (BJ Company)

Environmental logistics refers to the process of logistics to curb the harm to the environment, and at the same time to achieve the purification of logistics environment, so that logistics resources can be fully utilized. It includes the logistics operation link and the greening of the whole process of logistics management. From the perspective of logistics operation, green transportation, green packaging, and green circulation

processing is included. From the perspective of logistics management process, mainly from the goal of environmental protection and resource conservation to improve the logistics system, we should consider not only the greening of forward logistics links, but also the greening of reverse logistics system in the supply chain. The ultimate goal of green logistics is sustainable development, and the criterion to achieve this goal is the unity of economic interests, social interests and environmental interests.

For BJ, green not only means social and environmental interests, but also saves resources and minimizes the impact of iron and steel logistics activities on the environment. Besides, it can reduce the cost. Therefore, we need to pay special attention to this when setting the evaluation index.

3.5 Theory of Service Quality

3.5.1 Service Quality

The international concentrated research on service management began in the 1970s. At that time, the deregulation of service industry in western countries promoted the transformation of service industry from a monopoly industry to a competitive industry. Because service quality is directly or indirectly related to cost, customer satisfaction, customer loyalty, customer retention and profitability, it is the most important determinant of enterprise marketing effect and economic benefits. Service quality research is one of the key areas concerned by service management researchers. The concept of service quality is introduced from the quality concept of tangible products. Traditionally, there are several kinds of perceptions about the quality of tangible products: no flaw; compliance with certain norms or standards; the degree of satisfaction with customer needs; the incidence of internal failure (before the product leaves the factory) and external failure market performance rate. With the all-round development of the service industry since last century, scholars have begun to notice that services are different from products because of the invisibility and difference of services and the simultaneity of production and consumption and realize that there is a great difference in connotation between the concept of service quality and the concept of tangible product quality.

3.5.2 Customer Perceived Service Quality

The research on service quality focuses on the service quality gap model, and the more influential ones are the customer perceived service quality model and the PZB

five gap and tolerance region model.

The term perceived service quality was first put forward by Swedish service marketing expert Gronroos in 1984, who believed that service quality should be a subjective category, the quality felt by customers is important, and the final evaluator of service quality should be customers rather than enterprises. Gronroos pointed out that service quality can be divided into functional quality and technical quality, and on this basis, a customer perceived service quality model was proposed. After two modifications in 1988 and 2000, a more perfect customer perceived service quality model was formed. The model holds that the overall perceived service quality is the gap between the customer's expected quality and the actual perceived quality. If the customer perceived service is better than expected service, customer satisfaction will be higher, and enterprise will think that the service quality level is higher. On the contrary, the level of service quality of enterprises is lower. Among them, customer expected quality is affected by market communication, image, word-of-mouth and customer needs. The technical quality and functional quality of the enterprise determine the actual perceived quality through corporate image. At the same time, the overall perceived service quality in turn affects corporate image.

Based on Gronroos's model, Bolton and Drew (1991) considered the influence of organizational and engineering characteristics on service expectation and perception, and emphasized that service satisfaction is not only the result of the gap between expectation and perception, but also the decisive factor of customers' overall perceived service quality. The 4Q product/service quality model put forward by Gummesson (1993) on the basis of Gronoroos model emphasizes the influence of image and brand elements. Brogowicz et al. (2009) proposed a comprehensive model of customer perceived service quality, which subdivides the gap of customer perceived service quality into technical quality gap and functional quality gap, and includes human resources and tangible elements, corporate image and corporate mission in the factors that affect customers' expectation and perception of service. It can be seen that scholars believe that the core of the formation mechanism of service quality is the perceived gap.

In 1985, Parasuraman, Zeithaml, Berry (referred to as PZB) constructed Service Quality Gap Analysis Model along the idea of Gronroos, which holds that there are five gaps in service quality (1) the gap in managers' understanding, which means that managers' perception of expected quality is not clear; (2) the gap in quality standards,

which refers to the inconsistency between service quality standards and managers' understanding of quality expectations. (3) service transaction gap, which means that the behavior of employees does not meet the quality standards in the process of service production and transaction; (4) the gap of marketing communication, which means that the commitment made by the marketing communication behavior is not consistent with the service actually provided; (5) the perceived service quality gap, which means that the perceived or experienced service is different from the expected service.

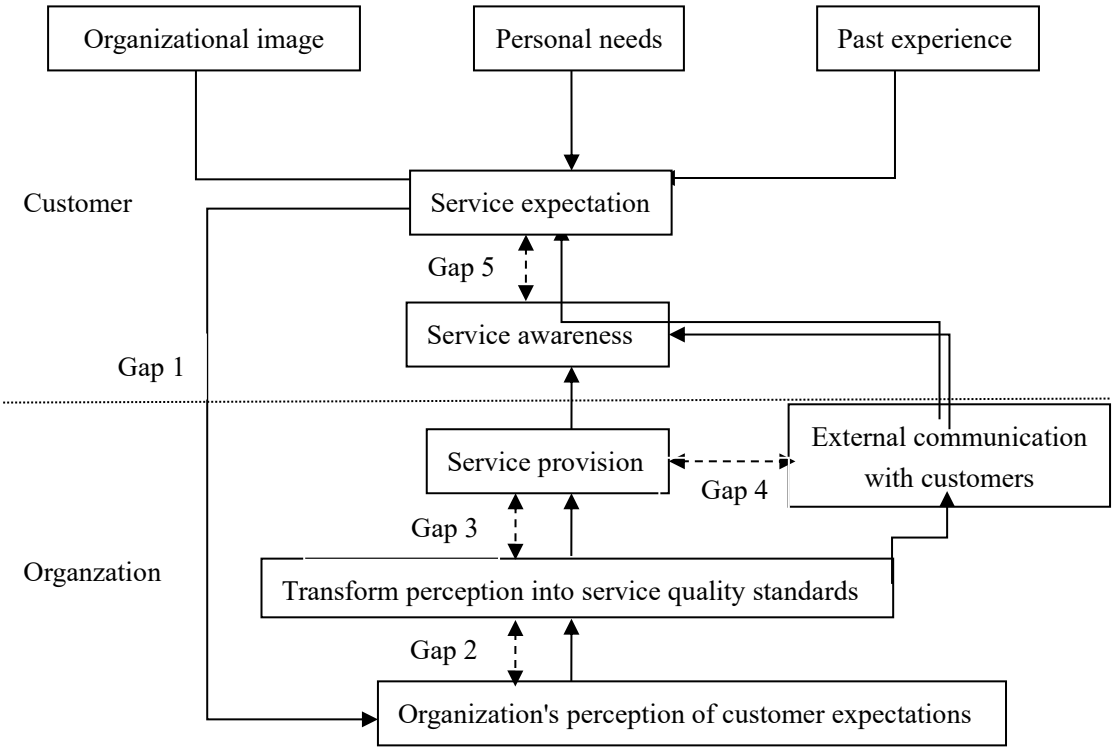

Figure 3-8 PZB Service Quality Gap Model[10]

3.5.3 Service Quality Evaluation Model

In the existing literature, models and methods for evaluating service quality are based on the analysis of customer perceived service quality and service quality gap. At present, the development of evaluation model is divided into two schools of thought: one is to continue to modify and improve along the SERVQUAL model proposed by PZB, and the other is to seek a breakthrough in the model composition mechanism and evaluation methods with a critical attitude to the SERVQUAL model.

[10]Source:ParasuramanA.,ZeithamlV.A.,BerryL.L.AConceptualModelofServiceQualityandItsImplicationsforFuture Research[J].JournalofMarketing,1985,49(Fall):44.

At present, common ones are SERVQUAL model, SERVPERF model, probability model, weighted performance evaluation method, attribution model, non-difference evaluation method, and key event technology.

(1) SERVQUAL Scale

Different from quality of tangible products, service quality is difficult to measure accurately in practice because of its invisibility and particularity, which gives birth to the establishment of SERVQUAL scale. After further research, three PZB scholars put forward the SERVQUAL (Service Quality abbreviation) scale (see Table 3-4). In SERVQUAL service quality evaluation model, the customer's expectation of service quality provided by the organization is compared with the actual service status they receive, and the perceived results are evaluated, which forms the customer perceived service quality. The scale is composed of 22 questions in 5 dimensions: Tangibility, Reliability, Responsiveness, Assurance and Empathy, to obtain the measurement value of service quality. Later, this model is also called SERVQUAL evaluation method.

Tangibility evaluates service equipment, facilities and demeanor of service personnel. Reliability evaluates whether service organization can provide safe and reliable services for consumers. Responsiveness evaluates whether service organization is willing to provide timely and effective services to consumers. Assurance evaluates whether the knowledge and skill of service personnel enable consumers to produce sense of security. Empathy is to evaluate whether service personnel can care for consumers and provide humanized services for consumers. The scale is divided into two parts: the customer's expectation score for a certain type of service and the customer's actual feeling score. Each part has basically the same 22 indexes. The score of service quality (Q) is equal to the difference between expectation score and actual perception score, which indicates that the actual perception of service is basically consistent with consumers' expectations when $Q>0$; when $Q>0$, the actual perception of service is higher than consumers' expectations and customers are satisfied with the service; when $Q<0$, it means that the actual perception of service does not reach the level of consumers' expectations, and customers are not satisfied with the service.

Tangibility involves 1-4 questions in the questionnaire, reliability is 5-9 questions in the questionnaire, responsiveness is 10-13 items in the questionnaire, assurance is 14-17 items in the questionnaire, empathy is 18-22 items. The questionnaire is based on a 7-point system, and the overall service quality is the

weighted average of the service quality gap in each index. After being put forward, the evaluation model is considered to be the most important method and widely accepted by managers and scholars, because it can be used as a reference for other evaluation models and methods.

Table 3-4 SERVQUAL Scale[11]

Service Quality Attribute Dimension	Elements of Service Quality
Tangibility	1 Have modern service facilities
	2 Service facilities are attractive.
	3 Employees have neat services and appearance.
	4 Facilities for organizations match their services.
Reliability	5 Things promised by company to customers can be completed promptly.
	6 Customers can show concern and help when encountering difficulties.
	7 Companies are reliable.
	8 Accurate delivery of promised services.
	9 Correct recording of relevant services.
Responsiveness	10 They cannot be expected to tell customers exactly what time they want to provide services*
	11 It is unrealistic to expect them to provide timely services*
	12 Employees are not always willing to help customers*
	13 Employees are too busy to provide immediate services to meet customer needs*
Assurance	14 Employees are trustworthy
	15 Customers feel relieved when they engage in transactions
	16 Employees are polite
	17 Employees can receive appropriate support from companies to provide better services
Empathy	18 Companies will not provide individual services to different customers*
	19 Employees do not give customers individual care*
	20 Employees cannot be expected to understand customer needs*
	21 Companies do not give priority to customer interests*
	22 Service time provided by company cannot meet all customers' needs*

Note:

1 The questionnaire adopts a 7-point scale, 7 indicates complete agreement and 1 indicates complete disagreement.

[11]Source：A. Parasuramn, Valarie A. Zeithaml, and Leonard L. Berry. SERVQUAL: A Multiple-Item Scale for Measuring Consumer Perceptions of Service Quality, Journal of Retailing,1988,64(01):12-40(Spring).

The median score indicates different degrees. The questions in the questionnaire are arranged at random.
2 * indicates that the grading of these questions is reversed and be turned to a positive score before data analysis.

Later PZB makes revisions to this model to adjust evaluation level from 7 to 9 points, emphasizing that while using this model we must adjust the items appropriately to ensure that quality evaluation is scientific and accurate and we need to adjust 5 dimensions if necessary to meet different needs.

(2) SERVPERF (Service Performance) Evaluation Model

Cronin & Taylor (1992) questioned SERVQUAL model and considered that this model was only a theoretical model and lacked empirical research tests. Based on SERVQUAL model, they propose performance perceived service quality evaluation model namely SERVPERF evaluation model. This model uses only one variable of service performance instead of two variables of service expectation and service perceived gap to evaluate customer perceived service quality. The model also considers that SERVQUAL model may generate repeated computation expectation and result in fluctuation impact of evaluation value. Moreover, in measuring all indexes, we no longer use weighted average method, avoid the phenomenon of subjective consciousness influence factor weight, thus usability improves easily.

SERVPERF and SERVQUAL, however, have no obvious innovation in index design and computing methods, and have applications in catering enterprises and urban public transportation industries. Many PZB followers insist that SERVQUAL model outperforms SERVPERF evaluation model. Quester thinks SERVQUAL method outperforms SERVPERF method, while Teas and Su Yunhua demonstrate that SERVPERF method outperforms SERVQUAL method in reliability validity.

Empirical research suggests that the two kinds of customer perceived service quality evaluation methods are consistent with each other, each with accurate dimensionality classification, higher reliability, validity and variability interpretation ability but SERVPERF is better than SERVQUAL method.

(3) Probabilistic Model

Erto and Vanacore (2002) proposed probabilistic methods for evaluating and controlling hotel service quality based on Kano 2D model and carried out empirical research. The results show that from the perspective of customer perception importance, factors influencing hotel service quality include basic quality factors: customers don't pay attention to these factors but if lack often leads to customer

dissatisfaction; expectation quality factor: If these factors are more often provided at a higher level, customers will be more satisfied. Charm quality factor is a factor which exceeds customer expectation, belonging to adding brilliance to service quality and the absence of it has no effect on service quality.

(4) Weighted Performance Evaluation Method

Weighted performance evaluation method, proposed by Mazis (1975), emphasized the influence of customer perceived difference on service quality evaluation, while customer expectation is often ignored in past evaluation models. Therefore, different customers' perceived differences can be expressed by weight of different factors. Bolton & Drew (1991) suggested that customer perception and expectation would affect customer perception of service perception so it is better to evaluate customer perceived service quality without using weighted approach or customer expectation directly using service performance to measure service quality directly.

(5) Attribution Mode

Attribution is a psychological phenomenon, which refers to the process in which individuals speculate and judge causes of behavior according to relevant information and clues in the field of psychology. Attribution is a universal need of human beings, and everyone has a set of methods and patterns of behavioral causes induced from their own experience. In the field of service management, attribution refers to a psychological state in which customers actively look for causes of inconsistencies and adjust self-perceived standards and perceived behavior when they feel that the actual service and service expectations are inconsistent. Weiner (1984) and Bitner (1990) successively proposed and verified this method to evaluate customers' perceived service quality from a psychological point of view. The evaluation theory makes a large number of empirical tests on PZB's SERVQUAL model, and concludes that the main difference between itself and other evaluation methods is that: First, psychological variables are added to the process of measuring customer expectations and service perception, and customers will form a psychology of satisfaction or dissatisfaction after completing the gap comparison. Secondly, service providers can influence customer psychology and customer expectations by improving their service management strategies, so as to be more satisfactory. The evaluation result of attribution method is to form the psychology of customer satisfaction or dissatisfaction, and the psychology of satisfaction will affect customers' overall

perception of service quality and customer loyalty, which is the process and result of customer attribution.

(6) Non-Difference Evaluation Method

On the basis of questioning the SERVQUAL model, Brown, Churchill & Peter (1993) believed that the best evaluation method was to directly evaluate the difference between customer performance perception and service expectations. Therefore, they call this evaluation method Non-Difference evaluation method. The SERVQUAL model evaluates 22 questions from three aspects: customer expectation, performance perception and perceived service quality, and a total of 66 sets of data are used. Different from that, the non-difference evaluation method only needs to measure the difference between customer expectation and performance perception, and a total of 22 groups of data completes the evaluation. Therefore, it is much easier to use. Through a large number of empirical studies, it is proven that this evaluation method is superior to SERVQUAL model in terms of reliability and validity.

(7) CIT (Critical Incident technology)

Critical Incident technology is a kind of survey technology that qualitatively visits the needs of customers, asking customers to express and record feelings of satisfaction or dissatisfaction in the process of service. This survey is related to customer evaluation of service, mistakes in the service process, service recovery, and customer experience in service. Because it is very helpful to improve the service quality, it has gradually developed into a qualitative evaluation technology to observe the organization's service quality level by recording events or behaviors that the organization's customers are satisfied or dissatisfied with in the service process.

The main advantages of CIT are as follows: it is easier to find out the real reasons for superior or low quality by qualitatively collecting customers' feelings and evaluation of the service process rather than using the easy-to-calculate but cold score method. This method enables service providers to understand the relevant information clearly and then take action accordingly. When the question is difficult to define or other methods cannot be used accurately, the research is particularly precious; in the cross-cultural context, the interviewed customers are happy to answer because it is an open question, thus ensuring the effectiveness of the evaluation results.

(8) Evaluation Method of Customer Satisfaction

The service quality directly affects the customer's attitude towards the service. Whether the customer is satisfied with the service or not is based on the result of a

certain acceptance of service. If the customer expectation is consistent with the service quality perceived by the customer, the customer is easy to feel satisfied. Customer satisfaction (CS) is used to quantitatively reflecting the degree of psychological satisfaction of customers after receiving service when comparing service expectation and perception.

The main evaluation methods of customer satisfaction include American satisfaction of customer index (ASCI) and Chinese customer satisfaction index (CCSI), among which ASCI is the most influential and widely used evaluation model. In the ASCI model, customer satisfaction index consists of six kinds of variables, such as customer perceived quality, customer expectation to service, customer perceived service value, customer satisfaction to service, customer complaint to service or organization, and customer loyalty. Among them, the first three are antecedent variables, which directly affect customer satisfaction, and the latter three are result variables.

In addition to the above evaluation methods, there are other methods for service quality evaluation at home and abroad, such as index tree method, AHP method, fuzzy evaluation method, neural network, grey correlation degree, D-S evidence theory, and matter element method.

Reviewing the existing research results, it is not difficult to find that it is much more difficult to measure and evaluate service quality than to measure product quality. Both mainstream and non-mainstream evaluation models and methods have been further improved and optimized. As PZB and other scholars said, it is difficult to design a service quality evaluation system which is generally applicable to all kinds of services. The evaluation principles and methods used in the existing evaluation models are subjective, which will affect the objectivity and fairness of the evaluation results. And in different types of services, the main factors affecting service quality are not consistent, and even it is difficult or impossible to put all dimensions into the evaluation model.

3.5.4 The Application of This Theory in Study (BJ Company)

Service Quality refers to the sum of characteristics and features that the service can meet the prescribed and potential needs, and the degree to which the service work can meet the needs of the served. It is not only the lowest service level provided by the enterprise to make the target customer satisfied, but also the degree of continuity

that the enterprise maintains this predetermined service level.

In view of the customer participation in the service transaction process and the inseparability of production and consumption, service quality must be recognized by the customer. Service quality is the object perceived by customers, should be formulated and measured by objective methods, and more should be measured and tested according to customers' subjective understanding; service quality occurs in the process of service production and transaction; service quality is realized in the moment of the transaction between service enterprises and customers; the improvement of service quality needs to form an effective management and support system internally.

As a logistics support system, third-party logistics serves the first party and the second party, so customer value and customer satisfaction must be put in the first place. Therefore, the evaluation of service quality must be based on the theory of service quality. Especially in the investigation of customer satisfaction, we will refer to the scale of perceived service quality and related theoretical system.

Customer satisfaction, however, is not enough to cover all meanings contained in the logistics quality management index system, so this study will increase innovation, greening and other factors on the basis of service quality management theory, and then more comprehensively and practically reflect logistics quality.

3.6 Balanced Scorecard Theory

Balanced Scorecard (abbreviated as BSC) is a performance evaluation method widely used in the field of business management in recent years. It was put forward by Robert S. Kaplan, a famous American scholar in the 1990s. Because of its clear organization, easy to understand, easy to implement, and advocating balanced development, it has been paid more attention by the theoretical and practical circles.

3.6.1 Basic Contents of Balanced Scorecard

Balanced Scorecard provides us with an effective framework for enterprise performance evaluation. It makes us not limited to the traditional financial perspective, but to comprehensively evaluate the performance of enterprises from multiple perspectives. The usual balanced Scorecard contains four perspectives, financial perspective, customer perspective, internal business process perspective, development

and learning perspective. The four perspectives are interrelated and influence each other to form an organic whole. Each of these dimensions is described below.

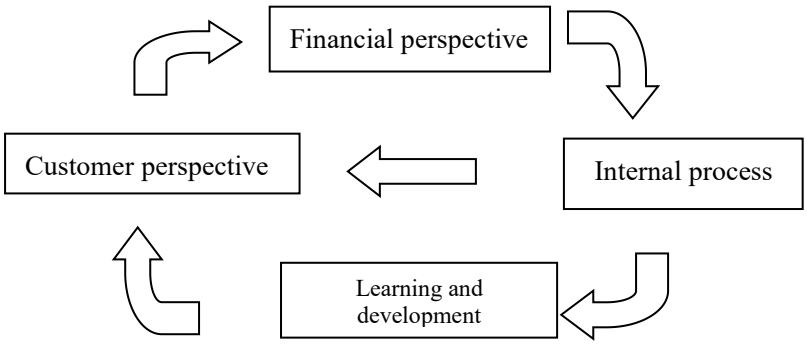

Figure 3-9 Contents of the Balanced Scorecard

Qin Yangyong, Tian Zhibao. Balanced Scorecard and Performance Management--Strategic Guidance of Chinese Enterprises [M]. China Economic Publishing House, 2005.

Financial indexes are not only the ultimate goal of enterprise operation, but also the fundamental purpose and result of other three perspectives.

The customer perspective is the perspective that reflects the external service ability of the enterprise. In order to achieve financial goals of the enterprise, enterprise must effectively subdivide the market, find the target customer base, provide quality service, and make the customer satisfied.

The perspective of internal business process dimension refers to improving the efficiency of internal business, reducing costs, providing high-quality customer service, optimizing production process, and increasing R&D speed of new products.

The dimension of learning and development refers to providing employees with opportunities for continuous learning and career development, so as to make employees satisfied. Today, with the rapid development of science and technology, only by promoting employees' continuous learning can we ensure the achievement of enterprise goals.

3.6.2 The Concept Advocated by Balanced Scorecard

The balanced Scorecard embodies two basic concepts, the concept of balanced development and the concept of causality chain analysis. The following is described in detail.

(1) Balanced Development

The biggest difference between balanced Scorecard and other enterprise

performance evaluation methods is balance, which is embodied in the balance between financial indexes and non-financial indexes, results and motivation, long-term goals and short-term goals. Among them, the balance between financial indexes and non-financial indexes is the most fundamental.

(2)Analysis of Causality Chain

There is an inherent logical relationship between the four perspectives of the balanced Scorecard. The balanced Scorecard is based on a chain of causality made up of a series of assumptions. This series of assumptions can be explained by the Z theory put forward by Halifax in performance drivers: If we use the right people (learning and development) to do the right things (internal processes), then customers will be very happy (customers), and we will maintain and develop more business (financial business).

The causality chain contained in the balanced Scorecard shows that the perspectives are interrelated, and the front perspective is the basis and necessary condition of the latter perspective.

3.6.3 Enterprise Performance Index System

(1)Financial Dimension

Financial dimension is the core of goals and indexes of the other three dimensions in the balanced Scorecard, and it is the most important goal for enterprises. The measurement index of financial dimension is the traditional index commonly used by enterprises. Generally speaking, the goal of the enterprise in the financial dimension contains two meanings: one is the goal of improving the productivity of the enterprise (improve the total factor productivity of enterprises, that is, increase the ratio of output to input), and the other is the goal of improving the operating income of the enterprise. The realization of these two goals depends on improving the operational efficiency of the enterprise's existing assets, reducing costs and increasing market share. The measurement indexes include return on net assets, economic value added, asset-liability ratio, return on investment, profit margin on sales, cost reduction rate, and net operating interest rate.

(2)Customer Dimension

Customers are the foundation for all enterprises to survive, and customers are the direct source for enterprises to achieve economic goals. To meet the needs of

customers and achieve a win-win situation is the common goal of all enterprises. Whether the enterprise can successfully meet the needs of customers and whether customers can maintain loyalty are all questions that customers think about in the dimension of customers. If we can strengthen customer management and optimize the delivery cycle, we can better improve customer satisfaction, and at the same time we can reduce shipping costs. Customer-level indexes usually include customer satisfaction, customer retention, customer acquisition, customer profitability, on-time delivery utilization, and share in the target market. Among them, customer satisfaction is the most crucial index, and the current customer relationship maintenance effect and operation status can be reflected by customer satisfaction.

(3) Internal Process Dimension

Internal process dimension of BSC is key to customer and shareholder. Internal business process transfers enterprise business idea to customers to attract new customers and maintain old customers. Moreover, shareholders' expectation on financial return is realized through internal business process superiority. It can also be understood as the goal of internal process dimension come from customer level objectives - strengthening customer management, understanding and meeting existing customer needs, attracting new customers to expand market share and also come from financial level objectives - achieving economic benefits and meeting shareholders financial returns requirements. Therefore, internal processes are no longer simply an improvement in business processes but also identify understanding and ultimately achieve customer and shareholder requirements.

Internal process dimension index involves enterprise innovation process management process and after-sale service process. Generally speaking, internal process dimension includes short term business improvement and long term product innovation. Shipping enterprises can design following specific indexes: service optimization capability, equipment utilization rate, storage cost reduction rate and environmental maintenance benefits.

(4) Learning and Growth Dimension

The dimension of learning and growth is not only the basis for enterprises to achieve long-term growth and improvement in the future, but also the basis for the realization of the strategic goals of the above three dimensions. Nowadays, with frequent technological changes and more resource and technology sharing platforms in the world, it is impossible to achieve the goals of the enterprise only by relying on

the limited technological advantages of enterprise while lacking excellent staff and technical team. The goal of the learning and growth dimension is to train employees with advanced technology and train management teams with advanced ideas. The balanced Scorecard assesses the strategic performance of enterprises from the perspective of personnel learning and growth, and agrees that a good corporate culture will promote the realization of corporate strategic goals. In order to achieve strategic goals, employees need to master the core technical capabilities necessary to achieve organizational goals, and managers need to have advanced management ideas and excellent leadership skills. Today, with the rapid development of information system, the establishment of enterprise strategic information platform is conducive to the efficient transmission of strategic information within the enterprise, so as to achieve the wide use of strategic information. The innovation ability of the organization is the source of vitality of an enterprise, and the continuous acquisition of new ideas will help to improve the efficiency of enterprise.

The index design of the dimension of learning and growth can be from the perspectives of employee ability, enterprise information system and organizational innovation ability. such as grass-roots staff training time, grass-roots staff turnover rate, working environment satisfaction, strategic information sharing degree, innovation ability evaluation, management training time, advanced and innovative logistics, and corporate culture identity.

The balanced Scorecard integrates four dimensions to design performance evaluation indexes, and supplements the traditional financial dimension indexes with three dimensions: customers, internal processes and learning and growth, so as to further enhance the ability of enterprises to evaluate future development prospects, and comprehensively evaluate the degree of achievement of strategic goals. Among them, customer dimension is the basis for achieving the goals of other dimensions, and the internal process dimension affects both the customer dimension (attracting new customers and expanding market share) and the financial dimension (meeting the financial return expectations of shareholders). The goal realization of the learning and growth dimension is conducive to better realization of goals of other dimensions.

The details are shown in Table 3-5.

Table 3-5 Balanced Scorecard Assessment Indexes

First-level index	**Second-level index**	**Third-level index**

Financial dimension	Improve the production capacity of enterprises	Production cost reduction rate
		Asset-liability ratio
		Exchange rate risk sensitivity
		Turnover rate of logistics assets
		Turnover rate of accounts receivable
	Improve the operating income of enterprises	Return on investment.
		Sales profit margin.
		Return on net assets
		Net operating profit
Customer dimension	Maintain customer loyalty	Customer satisfaction.
		Customer retention rate.
	Attract new customers	Customer acquisition rate.
		Customer profit rate.
		Target market share.
		Timely delivery utilization.
Internal process dimension	Understand and meet customer needs. Meet the financial returns of shareholders	New product launch cycle.
		Growth rate of R & D expenditure.
		Equipment utilization rate.
		Safety productivity.
		Reduction rate of warehousing cost.
		Utilization rate of production capacity.
		Degree of Collaboration among internal departments.
		Satisfaction with after-sales service.
		Brand maintenance and management.
		Environmental maintenance benefit.
Learning and growth dimension	Train employees with excellent skills	Training time for grass-roots staff.
		Turnover rate of grass-roots staff.
		Work environment satisfaction.
		Degree of strategic information sharing.
		Evaluation of innovation ability.
	Train a management team with advanced ideas	Length of management training.
		The advance and Innovation of Logistics.
		Degree of corporate cultural identity

Qin Yangyong, Tian Zhibao. Balanced Scorecard and Performance Management--Strategic Guidance of Chinese Enterprises [M]. China Economic Publishing House, 2005:30-31.

3.6.4 The Application of This Theory in Study (BJ Company)

The balanced Scorecard method breaks the traditional performance management method which only focuses on financial indexes. According to the balanced Scorecard, the traditional financial accounting model can only measure what happened in the past (backward outcome factors), but cannot evaluate the organization's forward-looking investments (leading driving factors). In the industrial age, the management method that pays attention to financial indexes is still effective. However, in the information society, the traditional performance management methods are not comprehensive, and organizations must obtain the driving force for sustainable development through investment in customers, suppliers, employees, organizational processes, technology and innovation. Based on this understanding, balanced Scorecard approach holds that organizations should examine their performance from four perspectives: learning and growth, business processes, customers, and finance. The goals and evaluation indexes in the balanced Scorecard come from organizational strategy, which transforms the organizational mission and strategy into tangible goals and indexes.

In this study, the more mature performance evaluation model of balanced Scorecard (finance, customers, internal operation, learning and growth) is introduced into the service quality evaluation index system of high-quality logistics, not only considering the value of customers, but also assessing the development level of employees, organizational processes, technology and innovation (IT technology), and environmental protection. It not only applies the useful experience and theory of predecessors, but also enables it to expand and innovate in new fields, which is conducive to the international integration and standardized development of evaluation indexes in the field of logistics in China.

3.7 Theory Review and Summary

The following will analyze above theories, and point out the application and shortcomings of these theories in this study. The particularity of iron and steel logistics: economy, cost, environmental protection, customer experience, so the following single theory cannot fully support the whole assessment system. Therefore, this thesis will construct a logistics service evaluation index system which is suitable for the development of BJ on the basis of comprehensive consideration of above theories.

3.7.1 Application and Evaluation of Total Quality Management

The core of total quality management is to run the idea of comprehensive control through the whole process of enterprise or organizational quality management, at the same time adopt the method of prior control and inspection, and adopt the method of establishing statistics to control the whole process of quality. *Three complete and one diverse* is the best summary of the content of total quality management, which includes full participation, whole process control, full scope of organization or enterprise as the object, and adopts a variety of methods to carry out quality management.

The material circulation enterprise of third-party logistics and its series of logistics activities, such as commodity transportation, inventory storage, order processing, circulation processing, packaging and distribution, and logistics information management, is a kind of socialized logistics system. Its basic function is to design, implement and manage logistics requirements in business activities, using modern logistics technology and logistics distribution network, according to the logistics contract signed with the first party (supplier) or the second party (demander), with the lowest logistics cost, fast, safe and accurate for users in a specific period of time, and at a specific price to provide personalized series of logistics services. Therefore, the assessment of logistics service quality has the characteristics of comprehensiveness, staff, prevention, service and science.

Therefore, this research designs the logistics quality service evaluation index system based on principles and characteristics of total quality management. It not only reflects the comprehensiveness of the assessment at the business level: economy, safety, speed, and environmental protection, but also necessary to reflect that the time dimension is comprehensive and scientific, that is, to use the method of PDCA cycle to realize the planning, execution, result comparison and feedback of service quality evaluation, and to select indexes from the point of view of all company staff. In this way, long-term success can be achieved through customer satisfaction and the benefit of all members of the organization and society based on quality as the center and full participation as the basis.

Previous studies focus more on internal coordination and dynamic management, rather than on evaluation and assessment. However, the current research is more

inclined to qualitative analysis, quantitative analysis is less in number, and cannot be indexed in the field of iron and steel logistics. This thesis will reflect the TQM theory from a quantitative point of view, and use PDCA cycle to compare before and after the application of indexes.

3.7.2 Application and Evaluation of Lean Management

Lean management originates from lean production. The core idea of lean management is to treat all non-value-added activities as waste. Lean thinking sums up the new management thinking contained in lean production from the perspective of theory, and expands the lean way to all fields(except the manufacturing industry), especially the tertiary industry. The lean production method is extended to all aspects of enterprise activities, which is no longer limited to the field of production, thus prompting managers to rethink the business process and eliminate waste and create value. Lean is customer-centered, so lean thinking is more focused on reducing waste, but when providing logistics services, we should not only reduce waste, but more importantly, add value and enhance customer experience.

The two most fundamental indexes of logistics management are to improve the service level and reduce the cost. This research holds that the evaluation of logistics service quality can provide management objectives and guidance for enterprise management, especially the assessment of economy, environmental protection and greenness, and evaluation indexes should be set up with lean ideas, so as to achieve overall cost reduction, effective use of resources and environment-friendly on a comprehensive and systematic basis.

3.7.3 Application and Evaluation of SCOR Model

Since the concept of supply chain came into being, the research of supply chain management and supply chain risk management has been very mature, and after 20 years of renewal and development, SCOR model, as an important way of supply chain optimization, has been verified by the application of major companies. In China, however, the application research of SCOR is still in its infancy and focuses on the manufacturing industry. The limitation of SCOR model is that it belongs to macro model, which is suitable for the improvement of the whole supply chain, and cannot analyze a certain link of the supply chain. At the same time, after using quantitative

performance evaluation to truly reflect the real problems of supply chain, great changes will be made from top to bottom when it is implemented. Therefore, in practical use, it is necessary to build organizational support and set up a high-level team, otherwise it will not be implemented when faced with change resistance.

Because of the maturity and applicability of SCOR for most enterprises, this thesis chooses to use it as a starting point to complete the exploration of the combination of supply chain management theory and the actual business of iron and steel logistics, and uses supply chain to analyze and solve problems of iron and steel logistics business. At the same time, the focus of the use of SCOR model is to analyze the problem and study the optimization scheme with the help of its mature system, so the limitation of its change implementation has a limited impact on the research.

3.7.4 Application and Evaluation of Green Evaluation of Logistics Industry

Environmental logistics refers to the process of logistics to curb the harm to environment, and at the same time to achieve the purification of the logistics environment, so that logistics resources can be fully utilized. It includes the logistics operation link and the greening of the whole process of logistics management. From the perspective of logistics operation, it includes green transportation, green packaging and green circulation processing. From the perspective of logistics management process, mainly from the goal of environmental protection and resource conservation to improve the logistics system, we consider not only the greening of forward logistics links, but also the greening of reverse logistics system in the supply chain. The ultimate goal of green logistics is sustainable development, and the criterion to achieve this goal is the unity of economic, social and environmental interests.

For BJ, green not only means social and environmental interests, but also saves resources and minimizes the impact of iron and steel logistics activities on environment. Besides, it can reduce cost, so pay special attention to this while setting the evaluation index.

This thesis combs and summarizes the existing literature from aspects of the research methods of the green efficiency of logistics industry, the relationship between the green development of logistics industry and the economy and the

environment, and the methods and countermeasures to realize green logistics, to find that there are following shortcomings.

(1) Fail to analyze and study the development of green logistics from regional and inter-provincial perspectives. The economic development of provinces and cities in China is unbalanced, and the research on the green development of logistics industry in sub-regions and provinces can achieve a specific analysis of specific problems, making policy recommendations more in line with local situation and improving the implementation effect of regional policies.

(2) The essential reasons for the low green efficiency of logistics industry are not explored from aspects of internal and external factors. Internal factors include the management level and technical level of logistics. External factors include the level of economic development, population size and energy structure. Based on a more detailed analysis of reasons affecting green efficiency, more targeted countermeasures and suggestions are put forward.

3.7.5 Application and Evaluation of Service Quality Theory

Service quality, especially customer perceived service quality is highly valued. After SERVQUAL evaluation model is put forward, it is considered by managers and scholars as the most important and widely accepted method, for it can be used as a reference for other evaluation models and methods. However, it still fails to reflect the characteristics of economy, cost and environmental protection of logistics industry. As a logistics support system, third-party logistics serves the first and the second party, so customer value and customer satisfaction must be put in the first place. Therefore, the evaluation of service quality in this study must be based on the theory of service quality. Especially in the investigation of customer satisfaction, we will refer to the scale of perceived service quality and related theoretical system.

In this study, the more mature performance evaluation model of balanced Scorecard (finance, customers, internal operation, learning and growth) is introduced into the service quality evaluation index system of high-quality logistics, not only considering the value of customers, but also is necessary to assess the development level of employees, organizational processes, technology and innovation (IT technology), and environmental protection. It not only applies the useful experience and theory of predecessors, but also enables it to expand and innovate in new fields,

which is conducive to international integration and standardized development of evaluation indexes in the field of logistics in China.

3.7.6 Application and Evaluation of Balanced Scorecard Theory

The balanced Scorecard method breaks the traditional performance management method which only focuses on financial indexes. According to the balanced Scorecard, the traditional financial accounting model can only measure what happened in the past (backward outcome factors), but cannot evaluate the organization's forward-looking investments (leading driving factors). In the industrial age, the management method that pays attention to financial indexes is still effective. However, in the information society, the traditional performance management methods are not comprehensive, and organizations must obtain the driving force for sustainable development through investment in customers, suppliers, employees, organizational processes, technology and innovation. Based on this understanding, the balanced Scorecard approach holds that organizations should examine their performance from four perspectives: learning and growth, business processes, customers, and finance. The goals and evaluation indexes in the balanced Scorecard come from the organizational strategy, which transforms the organizational mission and strategy into tangible goals and indexes.

In this study, the more mature performance evaluation model of balanced Scorecard (finance, customers, internal operation, learning and growth) is introduced into the service quality evaluation index system of high-quality logistics, not only considering the value of customers, but also is necessary to assess the development level of employees, organizational processes, technology and innovation (IT technology), and environmental protection. It not only applies the useful experience and theory of predecessors, but also enables it to expand and innovate in new fields, which is conducive to the international integration and standardized development of evaluation indexes in the field of logistics in China.

4 Analysis on the Present Situation of Logistics Service Quality Evaluation of Automobile Special Steel in BJ

This chapter mainly introduces the basic background of BJ, the current situation of the logistics service quality evaluation index of automobile special steel, the existing problems and the necessity of improving the logistics service quality evaluation index.

4.1 Basic Background of BJ

The following is discussed from three aspects: BJ's development history and business overview, BJ's development concept and development model, and BJ's organizational structure.

4.1.1 Development History and Business Overview of BJ

BJ, a logistics company founded in 1982, is one of the subsidiaries of China Logistics Group. In the tide of China's transition from planned economy to market economy, BJ has changed from a state-owned enterprise to a mixed state-owned and private domestic enterprise. In the course of nearly 30 years of operation, BJ has always been committed to providing customers with professional and high-quality logistics services. It insists on taking customer satisfaction as the work guide, adheres to the service tenet of everything for users and all convenience for users, and actively implements the principle of providing quality service and meeting customer requirements; giving priority to the humanized service concept of pollution prevention and environmental protection for the benefit of society, occupational health and safety, and safeguarding the rights and interests of employees. Combined with the scientific management of high-quality logistics, it has gradually developed into a professional logistics company with a certain scale, rich logistics experience and good social reputation.

BJ is a practitioner of high-quality steel logistics in China and a logistics leader in providing overall solutions for automotive steel processing and distribution. It is headquartered in Shanghai, China, with branches in Zhanjiang, Liuzhou, Wuhan,

Chongqing and Zhengzhou.

- Main products: provide overall solution of high-quality logistics for domestic automobile manufacturing enterprises.
- Main markets: East China, Central China, South China

With the goal of becoming the highest-quality logistics service provider and the highest-quality logistics value creator, BJ is committed to providing domestic customers with integrated solutions for high-quality logistics, shipping agency, multimodal transport, freight forwarder, warehousing, railway, road and supply chain, forming a fully functional network advantage on the basis of market segmentation, focusing on the development of automotive steel plate high-quality logistics so as to provide customers with overall logistics solutions of high value-added services.

Automobile steel plate logistics and scrap trade logistics account for the vast majority of BJ's total income, about 200 million yuan per year. As shown in Table 4.1 below:

Table 4.1 Share of Automobile Steel Plate Logistics and Scrap Trade Logistics in BJ's Revenue

Year	**2016**	**2017**	**2018**	**2019**	**2020**
Percentage	80%	82%	87%	92%	95%

4.1.2 Company Concept and Development Model

Business model is the basis of enterprise profit. Combined with its own development advantages, BJ subdivides the market of logistics industry, defines the position of the company, establishes a set of extension model of high-quality logistics service, provides customers with door-to-door high-quality logistics supply chain solution, and strives to become a leading comprehensive high-quality logistics service enterprise in China. In terms of management, BJ has established a model of centralized management and control of the headquarters and coordination of each branch business and marketing, which improves the efficiency of resource allocation, saves costs, and enhances the overall operational efficiency.

BJ provides safe distribution services for the daily production of steel to its main service customers including national automobile manufacturers, automobile matching factories, and auto parts processing plants. With its high-quality service and effective management mode, BJ has been highly evaluated and recognized in the customer base. Since 1992, BJ has begun to participate in the logistics work of the top 500 iron and

steel enterprises and become one of the logistics carriers recognized by an iron and steel group. It has been selected as the best logistics supplier of the year for many times, has won a number of best awards from the world's top 500 iron and steel enterprises and automobile manufacturing enterprises, and has been awarded the honorary title of excellent service provider for many years in a row. BJ takes this as the driving force for development, improves the internal management level, and constantly improves and optimizes all aspects of software management and hardware supporting.

Computer operation is used in logistics information processing and management, which greatly increases the accuracy and reliability. BJ Logistics Management Information system independently developed by itself provides employees with an automation platform for customer management, daily office, business analysis and other functions, so that they can timely and accurately feedback all kinds of logistics information needed to customers, and also enhance the comprehensive competitiveness of the company.

Through the empirical study on the logistics quality evaluation index of automobile special steel of BJ, the management standard of logistics quality evaluation index of automobile special steel of BJ is established. The management and decision-making of the logistics quality of automobile special steel is based on facts and results-oriented, which plays a strong strategic guiding role for BJ to do a good job of high-quality logistics service of automobile special steel.

4.1.3 Organizational Structure of BJ

The organizational structure of BJ is shown in Figure 4.1.

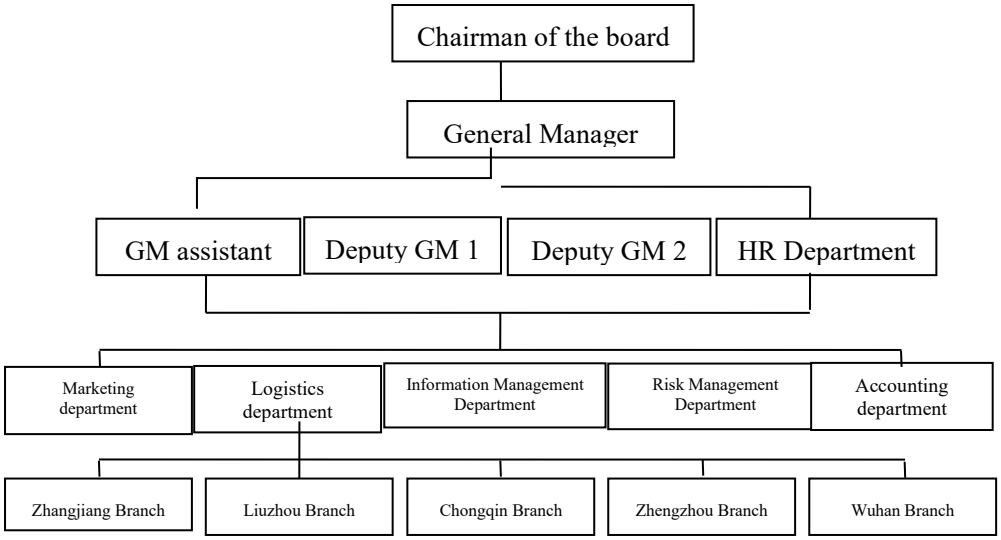

Figure 4.1 Organizational Structure of BJ

Source: BJ internal information

At present, high-quality logistics does not affect the enterprise organizational structure. When there are problems in the enterprise organizational structure, the organizational structure will hinder the enterprise's high-quality logistics business, resulting in a decline in customer satisfaction and an increase in enterprise costs.

4.2 Present Situation and Characteristics of High-quality Logistics of Automobile Special Steel of BJ

This part first introduces the concept and characteristics of high-quality logistics, and then BJ's strategy for high-quality logistics, work in the implementation of high-quality logistics, and the current situation of logistics service index system.

4.2.1 The Concept and Characteristics of High-quality Logistics

BJ insists on more than ten years' experience of high-quality logistics service quality, and on this basis, the content of high-quality logistics service roughly covers: Integrity, Safety, Greenness, Collaboration, Efficiency, and Economy. BJ believes that as the connotation of high-quality logistics, it runs through the corporate culture and daily business activities. As shown in figure 4.2.

Figure 4.2 Content Covered by High-quality Logistics

Lean logistics is a kind of logistics management idea originated from Toyota Motor Company of Japan, whose core is to eliminate all waste, including inventory, and develop a series of specific methods around this goal. It is transformed from the concept of lean production and is the application of lean thinking in logistics management, aiming to improve quality and efficiency according to standards (Paul Myerson, 2014). For example, Wang Haoyi (2015) constructed a relatively complete evaluation index system of lean logistics effect of automobile manufacturing industry in the supply chain environment from six aspects: environment, safety, personnel, quality, response and cost.

Fine logistics has been developed on the basis of lean logistics. delicacy management refers to the refinement of the work, so as to achieve the purpose of comprehensively improving the management level and work quality of enterprise. It is the need for enterprises to enhance their strength and surpass their competitors, and it is the inevitable choice for enterprises to pursue perfection and achieve the extreme. It is also a strong support for enterprises to ensure an invincible position in the fierce market competition (Chu Wenjing, 2014). The difference between the two lies in: lean logistics mainly focuses on the value-added and non-value-added activities in the whole supply chain, and uses lean tools and methods, such as high-frequency information chain, resource sharing, coordination, supply chain layout and other ways to improve the efficiency of supply chain; while fine logistics focuses on detail management in logistics, standardized operation, detail improvement of distribution methods, and implement the standards in all aspects.

In contrast, high-quality logistics needs to establish high-quality evaluation

indexes, which is the further sublimation and improvement of lean logistics and fine logistics. BJ insists on more than ten years' experience in the practice of high-quality logistics service quality, and on this basis, the content of high-quality logistics service roughly covers: Integrity, Safety, Greenness, Collaboration, Efficiency, and Economy. The research object of this thesis is high-quality logistics, which is applied to the logistics service of automobile special steel.

The relationship among lean logistics, fine logistics and high-quality logistics is shown in figure 4.2.

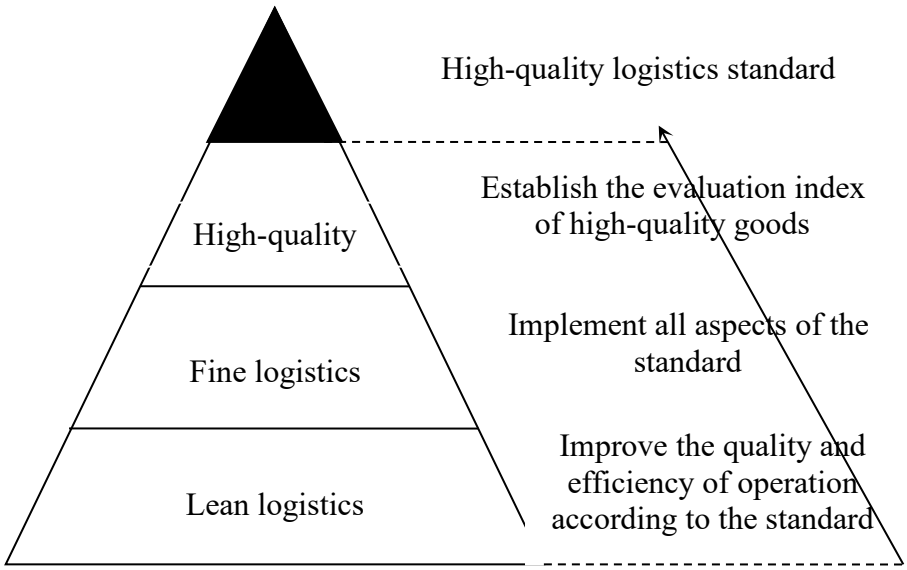

Figure 4.2 Evolution of High-Quality Logistics

Source: written by the author herself

(1) The Concept of High-Quality Logistics

First, the business goal of high-quality logistics, which refers to the realization of high-quality logistics services in the whole process of the effective flow of raw materials and products from the starting point to the end point and related information. It organically combines the functions of transportation, warehousing, loading, processing, distribution and information processing to form a complete supply chain and provide users with multi-functional and integrated services. Zero inventory, fast and punctual, economical and reasonable, and meeting the diversified needs of users has become an important part of high-quality logistics.

According to the principles of high-quality logistics and supply chain management, we need to build an information-based high-quality logistics network system, improve the operation efficiency of logistics system, reduce logistics costs,

promote common development, and improve comprehensive competitiveness to achieve goals of integrity, safety, greenness, collaboration, efficiency and economy.

Second, the extension of high-quality logistics. Take determining the logistics standard of maximum customer satisfaction as the core of high-quality route, adhere to the principle of lean management to eliminate the waste of logistics process and improve quality and efficiency, and apply the idea of delicacy management to the process of logistics quality control with the wisdom of science and technology, innovate and break through the traditional technology, improve the accuracy of every link of logistics operation, establish the quality evaluation index of high-quality logistics, take the index as the guide, and create the patent standard of the enterprise so as to create high-quality logistics products. To achieve ingenuity, the overall cost of supply chain is the lowest and the user experience is the most perfect, which reflects the professional, focused, dedicated, original, high-end high-quality concept.

Third, the development process from mass logistics to high-quality logistics. Mass logistics refers to the logistics development stage in the logistics industry, where the scale of logistics business is small, the carrying capacity is relatively weak, the service function is not complete, and the technical means of management is relatively low. The characteristics of enterprise are: lack of logistics facilities, business dispersion, intensive and operating advantages are not obvious, operational efficiency is low, the quality of user service cannot be guaranteed, and the efficiency of the enterprise is low. Most logistics enterprises can only provide individual or segmented logistics services, and the logistics functions mainly stay in storage, transportation and urban distribution, and there are not many value-added services such as packaging, processing and distribution. Moreover, a complete logistics supply chain cannot be formed, logistics channels are not smooth, logistics information transmission lags behind, and there are greater risks compared with high-quality logistics in terms of safety, environmental protection and economy.

The process of mass logistics and high-quality logistics has gone through the following four processes:

- A single transport enterprise is transformed into a warehousing logistics enterprise, and a single transport mode is transformed into a supply chain logistics of multimodal transport. The main assessment is the efficiency of transport volume.
- The warehouse enterprise has been transformed into an integrated logistics enterprise of packaging, distribution and handling, and the logistics supply chain management of

door-to-door warehousing, processing and distribution, assessing the ability to integrate logistics resources and serving customers' distribution capabilities of large-scale manufacturing.

- Comprehensive logistics enterprises have been transformed into modern logistics enterprises, assessing service scheme integration, specialization, personalization and modernization of management means.
- The transformation from modern logistics to lean logistics, highlighting the cost optimization principle of overall supply chain management.
- Lean logistics enterprises are transformed into high-quality logistics enterprises; in addition to assessing the economic indexes of the best cost of supply chain management, it is also necessary to assess the logistics indexes of integrity, safety, greenness, coordination and high efficiency.

(3) The Characteristics of High-quality Logistics

In BJ, the characteristics of high-quality logistics are shown in the following five aspects:

First, a high-quality logistics line has been established as a brand service product. Establish a strategic alliance collaboration mechanism with railway bureau, shipping company and road transportation company to plan the best logistics route, and scientifically choose transportation mode and control transportation cost for customers. Purchasing large van vehicles, renting warehouses, introducing management talents, and successively opening up a number of high-quality special lines from Shanghai to Guangdong, Shanghai to Guangxi, Shanghai to Zhengzhou, with the network basically covering large and medium-sized cities in China as one of the logistics brand service products of BJ.

Second, high-quality multimodal transport, which is based in Shanghai and serving all China. Door-to-door logistics service is provided by a special train all over China.

Third, establish a high-quality warehouse. BJ passed ISO9001 and ISO2000 quality system certification in 2002 and quality, environment and occupational health and safety integrated management system certification in 2006. It has established several high-quality warehouses with different areas in Shanghai, Zhengzhou, Chongqing, Liuzhou and other places, with special train lines, automobile plate hoisting and processing equipment. At the same time, establish information

warehousing management system and infrared monitoring, quality warehouse management system and post operation manual.

Fourth, implement high-quality system. For more than 20 years, BJ has established a quality system of safe, fast, punctual and efficient. It provides professional logistics services to users with high quality and honest service, reasonable price, perfect operation system, good management system, and achieves the quality goal of annual punctual arrival rate of 96% and customer satisfaction of 98%.

Fifth, greenness and environmental protection. Quality first, green environmental protection, innovation-driven, BJ and Tongji University jointly developed a protection project for automotive steel, with high standards and strict requirements in the field of automotive steel.

4.2.2 The Orientation and Strategy of High-quality Logistics

BJ takes the customer as the center, provides customized logistics services for customers, and creates a supply chain logistics solution for key customers.

(1) The Orientation of High-quality Logistics

The orientation of high-quality logistics enterprises is to make use of information, differentiation, integration and systematization to realize high-quality logistics service, aiming at automobile manufacturers, the world's top 500 raw material suppliers and manufacturers.

First, IT application, that is, the improvement of information management technology makes the efficacy and efficiency of the logistics industry be greatly improved, which also benefits from the wide application of Internet technology. The IT application of logistics industry promotes the efficiency of logistics system, promotes the transmission of logistics, and strengthens the sharing of information. Through the transportation and storage system of logistics, then combined with the IT application of logistics, logistics facilities will increase the coverage through the gradually expanded logistics network, and finally achieve the purpose of reducing logistics costs.

Second, differentiation is that under the market economy, due to differences in final products needed by retailers and production enterprises, intermediate products and raw materials are provided by special logistics centers to meet the different needs

of customers. However, there is a specialized division of labor between departments, and more detailed. Therefore, this kind of logistics center will save customer liquidity and logistics costs in the way of intensive logistics, finally driving the flow of funds.

Third, integration is that specialized production makes different automobile factories all need material transfer, and at the same time, part of the production process of automobile factories has a certain degree of independence. This kind of high-quality logistics, which is closely related to the production process, will gradually infiltrate and integrate into the production process, and finally realize the integration of logistics.

Fourth, systematization is from the aspect of organization and control in the enterprise. Compared with traditional logistics, high-quality logistics is managed systematically according to the perspective of whole supply chain. That is, on the basis of controlling the whole logistics supply chain, it can achieve the optimal effect of the overall chain cost, and its logistics system can reduce circulation links, promote the construction of a smooth, efficient and controllable circulation system, and reduce circulation costs to meet the changing needs of customers.

(2) The Strategy of High-quality Logistics

The strategic content of high-quality logistics includes strategic objectives, strategic advantages, strategic situation, strategic measures and strategic steps of high-quality logistics. Its specific contents are as follows:

First, the strategic goal of high-quality logistics is to achieve the lowest cost strategy on the premise of satisfying the best customer service: to reduce variable costs, including transportation and warehousing costs for example, the warehouse location of logistics network system, the comparison and selection of transportation schemes. In the face of competitors, the company should meet the service standards of high-quality logistics, and the minimum cost is to choose the optimal scheme with the lowest cost on the premise of maintaining improvement of service level.

Second, high-quality logistics improves service quality: service quality improvement is an effective measure to improve competitiveness. With the improvement of market and the fierce competition, customers not only consider the price factors when choosing the company, but also become more powerful bargaining chips for the company to arrive in time and accurately. A high level of service should be guaranteed by high cost, so it is very important for enterprises to weigh the comprehensive pros and cons. The index value of service improvement is usually

evaluated by the satisfaction rate of customer demand, but the final evaluation index is the annual income of enterprise.

Third, enhance the competitiveness of high-quality logistics market: on the premise of maintaining market competitiveness, BJ can adopt a variety of methods to reduce operating vehicle costs, improve operational efficiency, use JIT strategy to enhance user satisfaction, or use the third-party logistics service model to enhance the overall supply chain needs of users, and enhance the competitiveness of the high-quality logistics market.

Logistics strategy can be divided into four levels: overall strategy, structural strategy, functional strategy and basic strategy.

(1) Overall strategy-the ultimate goal of logistics management is to meet customer needs, so customer service should become the overall strategic goal. Establishing the evaluation index system of user service for the overall strategy and implementing the customer satisfaction project are the key measures for the implementation of the strategy.

(2) Structural strategy-structural strategy includes channel design and network analysis.

- Channel design. By optimizing the logistics channel and reconstructing the logistics system, the agility and adaptability of the logistics system can be improved, and the logistics cost of the member enterprises in the supply chain can be reduced.
- Network analysis. Network analysis provides reference for optimizing logistics system through inventory analysis, user survey, transportation mode analysis, information and system status analysis, and partner performance evaluation. Its purpose is to improve inventory management, improve service level, and enhance the efficiency of information exchange and transmission.

(3) Functional strategy-functional strategy refers to the timely, appropriate and efficient operation of logistics process by strengthening the management of logistics functions, such as logistics management, transportation, and warehousing management. Its main contents include the optimization of the use and scheduling of means of transport, the adoption of procurement and supply methods and strategies, inventory control and warehousing management.

(4) Basic strategy-basic strategy provides basic guarantee for the normal operation of logistics system, including organizational system management,

information system management, policy and strategy management, and infrastructure management.

However, BJ does not have a clear positioning for its logistics strategy.

4.2.3 The Implementation of High-quality Logistics

High-quality logistics implements collection and distribution centers through logistics companies to improve logistics and distribution functions. Compared with the level of high-quality logistics, BJ is only one step behind it in logistics and distribution centers. Therefore, BJ has a certain foundation for the development of high-quality logistics on the basis of traditional warehousing, as long as it needs to improve the function of traditional warehousing and establish logistics and distribution centers with the same characteristics as high-quality logistics to achieve both socialized and professional service and make BJ a real high-quality logistics supplier. The establishment of a steel logistics service platform is a high-quality logistics supply chain and a systematic project, including all necessary links in the fields of transportation, warehousing, allocation, shearing, processing, packaging, distribution, commerce, and settlement. As shown in figure 4.2:

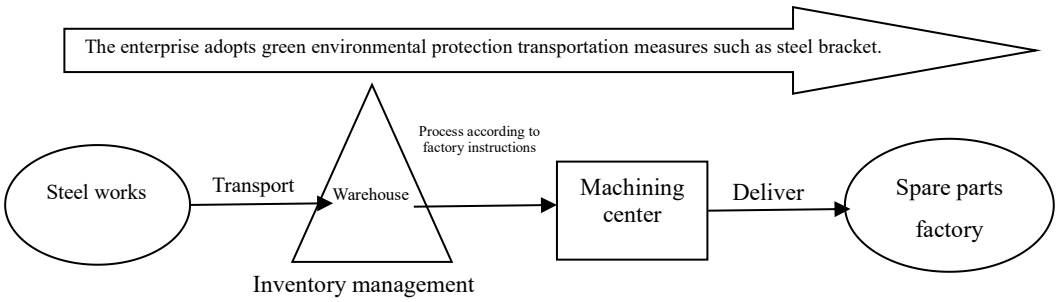

Figure 4.2 Implementation Model of High-quality logistics

The above figure shows that in steel logistics, with more detailed specialization and the expansion of non-core processing outsourcing in processing and assembly enterprises, manufacturers have handed over the real power of supply logistics to a third party in order to reduce the cost in the supply chain.

(1) A Case of Personalization and Customization of High-quality Logistics

BJ, as a TY customer full-process high-quality logistics service provider, attaches great importance to user inventory management, to reduce the impact of user inventory imbalance on production, formulate customized service programs.

Due to uncontrollable factors on the way of railway transportation and the

limitation of local hardware facilities in Zhengzhou, materials shipped by the railway to the Zhengzhou factory have been in a situation of high logistics damage. In 2013, the average PPM of logistics cargo loss was as high as 6858, equivalent to about 0.68%, causing trouble to the production of users. In order to solve the problem of high cargo damage in Zhengzhou logistics, a series of strong measures were taken with Southern Company in the second half of 2014 and the first half of 2013 to effectively contain the problem of high cargo loss in Zhengzhou.

The following measures have been taken:

- Assist users to evaluate the reasonable inventory and risk inventory needed for production.
- Customers' inventory capacity is comprehensively balanced with the inventory capacity of Shanghai warehouse and Kaiping plant.
- Master the rhythm of Kaiping factory, follow up and manage the whole process.
- Strengthen the communication of railway departments to ensure the supply of materials under tight transport capacity, such as Spring Festival transportation.
- Prepare and implement emergency plans.

In view of the above measures, the development and establishment of a new railway transfer station, the backward hardware facilities and non-standard unloading of the 15th Bureau of China Railway, a new transfer station was opened in Putian, Zhengzhou, and an indoor warehouse of 1500 square meters was established. Standardized operation training was carried out for the storage and loading of unloading and transfer materials; Zhengzhou localization short barge distribution vehicles were upgraded and equipped with wave frames and rubber pads. During the railway transportation, the foaming material of 5cm thickness is pasted at the contact position between the steel coils to prevent each other from scratching.

Through the implementation of the above series of measures, the logistics loss in Zhengzhou showed an obvious downward trend in 2014. The PPM value decreased from 6987 in February to 5108 in March, 3889 in April, 1686 in May and 880 in June, controlled within 1000PPM. As a window for serving users, we strive to practice one-stop service and provide users with close services. The effective improvement of Zhengzhou logistics damage is a successful practice of the output of high-quality logistics service mode, which further verifies the ability of BJ to provide standardized services.

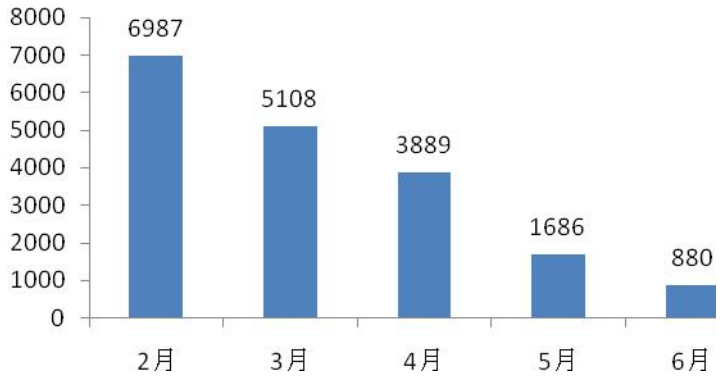

Figure 4.3 Changes in Cargo Losses of TY Company from February to June 2013 (PPM value)

(2) A Case Study of User Adhesion in High-quality Logistics

Logistics user adhesion is to let users have a sense of dependence on high-quality logistics, in the case of the elements of high-quality logistics to play a role, for users to produce supply security and stability, the lowest cost economy, but also the improvement of user satisfaction.

For example, a strategic user of an automobile adopts the following strategy, considers reducing the logistics cost, and places an order with a local steel factory recently, while the steel factory is forced to set up a branch plant in a place with dense users due to market competition, and a strategic user of an automobile chooses to place an order at the branch factory, which creates conditions for BJ to carry out high-quality logistics services. BJ launched a high-quality logistics program to improve customer satisfaction, formulate an integrated high-quality logistics plan for a strategic automobile user, and enhance its adhesion to logistics companies and customers, taking the following measures:

First, keep in line with the nodes of Zhanjiang production and users switching manufacturing bases, set up Zhanjiang branch, send experienced professional management team from Shanghai to promote specialization and localization, and keep in close contact with Liuzhou branch and Shanghai headquarters.

Second, keep active communication with Zhanjiang Logistics Department, and after the plant special railway line is put into operation, it will use the plant special railway line for loading and delivery.

Third, with reference to the successful service model from Shanghai to Liuzhou for years, we provide users with door-to-door one-stop distribution service.

Fourth, according to the transport volume, order 5-10 box cars, which will be

configured in place within three months before the start of business to ensure that the product quality is intact.

Fifth, BJ actively participates in the mature agile manufacturing system of steel mills and the production base of steel mills' machining center, realizing real-time sharing of Zhanjiang ex-factory logistics information, Liuzhou high-quality warehousing, processing and distribution information with users, and coordinated development to serve users.

Through the adjustment of transportation scheme, we can reduce the transportation cost for customers, reflect the economic characteristics of high-quality logistics, and improve the adhesion of customers to BJ.

(3) The Implementation of Characteristics of Integration and Systematization of High-quality Logistics

The supply chain of high-quality logistics pursues the integrated and systematic characteristics of logistics organization. Specifically, make the logistics operation network and logistics information electronic. Therefore, logistics enterprises must, in order to provide fast and omni-directional logistics support to users, strengthen the coordination and collaboration in the logistics process and control the logistics process, and complete the logistics tasks in any region in the shortest possible time. At the same time, ensure that the logistics cost is reasonable.

First, based on information means, for all customer enterprises to ensure that the entire logistics network has the best overall inventory level and distribution, transportation and distribution is fast and efficient. Therefore, in the steel loading and unloading tally operation, through information means, using the hand-held terminal to collect the steel goods QR code information, distinguish the damage and ticket number, check the data through the system terminal, obtain the steel logistics tally data information in real time, realize the paperless of the whole operation line of shipside and vehicle real-time tally, and make the steel tally change from labor-intensive to technologically-advanced. Make full use of physical positioning technology to optimize and design the operation flow of steel loading and unloading tally business, 3G wireless network technology, WIFI wireless network technology, Web Service technology, two-dimensional video imaging acquisition technology design and system function development, to build a modern steel logistics management information system.

High-quality logistics is based on Internet technology steel loading and unloading operation management, ship and vehicle information management, bill of lading information management, inventory information management, damaged information management, damaged photo management, document printing management, vehicle, shipping company and port information management and other port supply chain entities such as information sharing and exchange and other functions. The application of two-dimensional imaging automatic data acquisition and other IOT technology to achieve steel logistics information collection and tracking.

Second, improve the comprehensive logistics service capability by improving the functions of logistics, warehousing and distribution. The service of high-quality logistics enterprises requires the integration of logistics functions and the serialization of logistics services. In addition to providing traditional storage, transportation, packaging, circulation and processing services, BJ should also provide complementary and serialized logistics value-added services with extended extension and deepening connotation, such as logistics consulting, logistics scheme selection and planning, payment recovery and settlement, and education and training. As an important part of the supplier and customer supply chain, the third-party logistics enterprise plays the role of macro-control of the whole logistics. For example: ①to strengthen the key role of trains in high-quality logistics, so that the monthly loading capacity of BJ has been increased from 60 wagons to 600 wagons, and the loading capacity has been greatly increased. ②BJ is the first enterprise to bring high-quality logistics to Zhanjiang region, providing door-to-door high-quality logistics service mode for users in Zhanjiang, and opening up the high-quality transportation business of automobile special railway in Zhanjiang area. ③to establish a high-quality warehousing to provide strategic users with high-quality services, so as to minimize the total cost of strategic users in Zhanjiang area.

E-commerce based on computer network catalyzes the revolution of traditional logistics industry. The third-party logistics enterprises need to integrate the logistics resources of the whole supply chain, and grasp the customer's commodity sales forecast, production plan to study the customer's transportation timing and route, warehouse design, personnel allocation and other information. Use its professional information technology and extensive expertise to provide users with the overall best logistics system and pursue the best of whole logistics supply chain. The

comprehensive logistics capability of enterprise is reflected in its IT application, automation, networking, intelligence and flexibility. See figure 4.4 for details.

Figure 4.4 High-quality Logistics Supply Chain Process

Third, through the implementation of the high-quality logistics scheme, the node control of the supply chain can be realized. For example: the improvement and implementation of the logistics high-quality scheme of GQ Group controls the overall supply chain node.

- According to the needs of GQ Group, we will formulate a high-quality plan, submit the product loading plan to Nanning Railway Bureau for approval, and sign a contract with it to complete the examination and approval within the limited time.
- By dividing the special freight yard through the railway and making a good quality control system, according to the requirements of the quality protection characteristics of products of an iron and steel enterprise, the special yard and operation area can be divided after the transformation of the freight yard, and protective facilities can be set up to prevent other vehicles and working equipment from entering the yard and affecting the quality of goods. Make the lower cushion and upper cover strictly according to the product stacking standard of a steel plant.

- Rapid information feedback, dynamic tracking of goods, equipped with railway freight car tracking management information system, can grasp the situation of freight cars on the way at any time, and provide on-the-way information of freight cars according to their needs.
- In order to ensure that goods can be shipped in time, a special logistics service team will be set up to take charge of receiving loading demand, reporting loading plan, purchasing, loading, and shipping to ensure timely delivery of goods. Every day, there are a large number of empty wagons available for mobile shunting in Zhanjiang Station, and the loading and unloading capacity of the freight yard has been greatly improved after the transformation, and there are a large number of experienced stevedores who can meet the shipping needs. In the case of centralized shipment in large quantities, special trains can be organized to be shipped to Liuzhou.

(4) The Embodiment of the Fine Characteristics of High-quality Logistics

High-quality logistics is an idea and a culture. It is a kind of enterprise management concept of BJ, and also the inevitable requirement of the refinement of social division of labor and the refinement of service quality to modern management, reflected on the basis of conventional management, and leads conventional management to fine thinking and management mode, which is to minimize the resources occupied by management and reduce management costs, and to ensure that the quality level of logistics products that serve customers cannot decline. Therefore, high-quality logistics embodies refinement on three levels: the first level is the standardization of high-quality logistics, the second level is the refinement of high-quality logistics, and the third level is the personalization (or differentiation) of high-quality logistics.

High-quality logistics management is to implement the management responsibility, which will be specific and clear. It requires every manager to be in place and with due diligence. For the first time, work should be done according to the standards of high-quality products, work should be cleared every day, the quality of work on the same day should be checked every day, and problems should be corrected in time.

(5) The Embodiment of Greening and Recycling of High-quality Logistics

High-quality logistics embodies the characteristics of green in the following

aspects:

- The enterprise has the social responsibility to write the green environmental protection into the corporate culture.
- To ensure that emissions of the enterprise's means of transport meet the standards.
- To open the precedent of green logistics in the iron and steel logistics industry, from the implementation of door-to-door high-quality logistics and distribution of automobile steel to the workshop of automobile factories, to the collection and transportation of scrap from automobile factories to steel enterprises for recycling, the real green circular logistics has been realized.
- Do a good job of reverse logistics to reduce transportation costs and improve business efficiency for customers.
- To promote high-quality transport schemes and adopt multimodal transport to improve transport efficiency.

4.2.4 BJ's Existing Logistics Service Evaluation System

BJ’s existing evaluation indexes are relatively scattered, and implementation and safeguard measures are also relatively tough, lack of flexibility.

(1) The Content of BJ's Evaluation Indexes

At present, BJ evaluation system is characterized by the main line of logistics business design indexes, index coverage of more quantitative evaluation, but less behavior evaluation indexes. It evaluates the logistics service capabilities of BJ, such as warehousing, transportation, loading and unloading, processing and distribution. The following aspects are involved:

First, warehousing evaluation indexes: warehousing damage rate, warehousing service delivery error rate, timely delivery rate of goods, warehousing operation plan completion rate.

Second, transport evaluation indexes: transport quality damage rate, transport equipment failure rate, timely delivery rate, capacity guarantee rate, timely return rate, transport operation plan completion rate.

Third, loading and unloading evaluation indexes: unqualified rate of loading and unloading tools, cargo loading and unloading quality damage rate, loading and unloading operation plan completion rate.

Fourth, processing and distribution evaluation indexes: processing finished

product rate, processing plan completion rate, processing packaging damage rate, timely delivery rate; customer satisfaction index.

(2) The Implementation and Guarantee of BJ's Evaluation and Assessment

At present, BJ's logistics service quality is assessed jointly by the Human Resources Department and the Finance Department. The assessment process of logistics quality is as follows:

First of all, the human resources department is responsible for compiling the evaluation implementation plan, designing evaluation tools, drawing up the evaluation plan, training the examiners at all levels, and putting forward the corresponding measures to deal with the evaluation results for the company leaders to make decisions.

Second, supervisors at all levels organize employees to write work reports and conduct self-evaluation. All employees summarize their work performance and behavior performance (work attitude, work ability) during the evaluation period, and the core is self-evaluation of their own responsibilities and objectives.

Third, according to the degree of completion of daily work objectives, management log records, attendance records, statistical data, and personal work reports, and on the basis of a full understanding of all aspects of the performance of the evaluatees, the department head is responsible for conducting objective and impartial assessment and evaluation, and points out that expectations or work suggestions of the evaluatee shall be submitted to the superior of the department for examination and approval.

Fourth, the supervisor is responsible for conducting performance interviews with subordinates. At the end of the conversation between the direct supervisor and the employee on the preliminary results of performance review, the employee can retain his or her opinion, but need to sign on the evaluation form. If employees have doubts about their own evaluation results, they have the right to report or appeal to their superiors. For employees who are sent to work in other places, the feedback interview will be conducted by the direct supervisor of the location of the employee.

Fifth, the human resources department is responsible for collecting all evaluation results, compiling a list of results, and submitting them to company leaders for review.

Sixth, the company leaders listen to the separate reports of departments, discuss and balance the key results, correct the deviation in the evaluation, and determine the

final evaluation results.

Seventh, the human resources department is responsible for sorting out the final evaluation results, keeping promises, and classifying and establishing employee performance evaluation files.

Eighth, the human resources department summarizes and analyzes the effectiveness of this performance evaluation, and puts forward new improvement suggestions and plans for future performance evaluation, and plans a new human resources development plan.

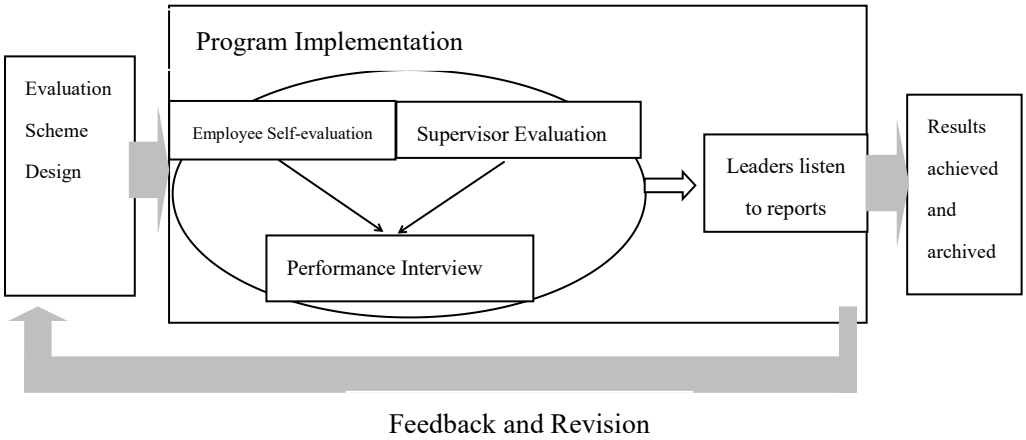

Figure 4.5 Evaluation and Assessment Process of Logistics Service Quality of Automobile Special Steel of BJ Co., Ltd.

At present, through the incentive mechanism for the Human Resources Department and the Finance Department, we can strictly ensure the effectiveness of the assessment indicators (which can reflect the actual situation). An objective and fair automatic assessment system of non-human intervention has not been established in terms of system and information system.

4.3 Problems at the Present Stage of Logistics Service Quality Evaluation Indexes of Automobile Special Steel of BJ

Under the double pressure of market competition and reform, it is an inevitable process for BJ to turn to high-quality logistics. However, in the process of transformation, traditional logistics enterprises should also, according to their current situation and development, combine the management experience of high-quality logistics at home and abroad, make good use of the original rich resources and

enterprise advantages, and on the basis of strengthening external cooperation and internal management, finally successfully transform to high-quality logistics. After research, the transformation of BJ is proposed to be realized through the following path.

To change the traditional conservative ideas, traditional warehousing and logistics enterprises have paid no attention to the study of consumer demand and market changes, which is not compatible with market economy. Enterprises must abandon the closed management style in the past and take the needs of users as their own responsibility, be close to the market, have accurate positioning, and gradually form a service function to adapt to the market demand.

In addition, due to the increase of competitive pressure, BJ pays more attention to the management of logistics supply chain. The customer is no longer the buyer of the sale and purchase transaction, but the cooperative partner of the cooperation and competition, and they together form partnership, which requires BJ staff to recognize the value and demand characteristics of the customer enterprise, and consider the value chain of the customer enterprise from the value chain of the customer enterprise, understand customer needs, maximize the value chain of customer enterprises, and optimize the overall cost of the supply chain for customers.

The SCOR model defines the supply chain as five processes: Plan, Source, Make, Deliver and Return. From the three levels of supply chain division, configuration and process elements, it describes the standard definition of each process, the corresponding measurement indexes of each process performance, and provides the supply chain best implementation and human resources plan. By using SCOR, we can communicate supply chain problems with the same language inside and outside the enterprise, evaluate its performance objectively, and define the goal and direction of supply chain improvement. But BJ currently lacks such a system. At present, the company's existing logistics service evaluation system has not been designed and improved according to high-quality logistics standards, which is embodied in the following aspects.

4.3.1 The evaluation index is scattered and cannot stimulate the enthusiasm of employees.

The platform integration ability of BJ is weak, and the efficiency of logistics

resource optimization and overall planning is not high. The indexes are not systematic and not related to each other, lack of science, cannot stimulate the enthusiasm of employees, and the evaluation characteristics of high-quality logistics are not reflected. Generally speaking, logistics service quality needs to be evaluated in six aspects: safety, quality, coordination, delivery, on-site and service.

- Safety Indexes: transport safety accident rate, qualified rate of emissions from means of transport, environmental protection standards.
- Quality Indexes: product packaging, product distribution, product quality, warehousing management, logistics coordination.
- Delivery Indexes: quality accident rate, product quantity difference rate, goods on-time delivery rate, freight cost.
- On-site Indexes: warehousing fire-fighting facilities, identification of operating areas, packaging and waste recovery rate, automatic management of loading, tools and measures for cargo protection, automatic management of goods in and out of warehouse, automatic identification of distribution information, accuracy of goods delivery station, completion rate of processing plan, matching of accounts and materials.
- Service Indexes: automatic input of logistics occurrence information, information specification of warehouse receipts and invoices, tracking management of quota delivery process, code of conduct of service personnel, economical and personalized transportation scheme.

But at present, there are only warehousing evaluation index, transportation evaluation index, loading and unloading evaluation index, processing and distribution evaluation index.

4.3.2 Lack of green and sustainable development indexes and difficult to carry out delicacy management

With the increasing deterioration of environment and the continuous consumption of resources, green problem has become a hot topic in today's society, and Green Supply Chain (GSC) arises at the historic moment. GSC originates from the traditional idea of supply chain management and sustainable development, and is a

supplement to the traditional supply chain. It was originally proposed by MRC, a manufacturing research association of Michigan State University in the United States. With the aim to comprehensively consider the environmental impact and optimal utilization of resources in the manufacturing supply chain, it is the intersection of ecological environmental protection, green manufacturing and supply chain management.

At present, the research on green supply chain has just started, and its concept definition is not complete and perfect. Green supply chain, a modern management model that integrates the ideas of environmental protection and resource efficiency in the whole supply chain, is based on green manufacturing theory and supply chain management technology from the point of view of product life cycle, and is comprehensive consideration of the whole process of raw material acquisition, design and manufacturing, packaging and storage, sales and transportation use and recycling of products. Through green technology and supply chain management means, the goal of minimizing the negative impact of the environment, the highest utilization rate of resources and energy and the best overall benefit of the supply chain system in the product life cycle can be achieved.

The special feature of green supply chain management is that it brings environmental objectives and resource conservation into one of the management objectives, changes the open-loop structure of the traditional supply chain and increases the role of recyclers, through the recycling process, to achieve the reuse of products or parts or the recovery of materials and energy, thus forming a logistics closed loop, which not only improves the utilization rate of resources, but also reduces the impact of waste products on the environment.

Although BJ attaches great importance to green and sustainable development, and made useful explorations in practice, it still lacks a complete evaluation index system of green supply chain, which cannot really promote sustainable operation, lack of contribution to society and environmental protection, and the assessment of departments and employees only stays in the stage of qualitative concept publicity and implementation.

4.3.3 The current indexes are not effective enough, so it is difficult for the evaluation system to be effective.

The factors that affect quality are called quality factors. The five factors that affect the quality are: Man, Machine, Material, Method, Environment, namely 4M1E:

(1) Man: people's ideological quality, sense of responsibility, quality concept, professional ability, and technical level directly affect the quality.

(2) Machine: the mechanical equipment used shall be suitable for production, reliable in performance, safe in use, convenient in operation and maintenance. Rational use of machinery and equipment and correct operation is an important link to ensure quality.

(3) Material: the quality of materials, parts and components should meet the relevant standards and design requirements. Strengthen inspection and acceptance, and strictly control quality.

(4) Method: the technological process, technical scheme, testing means and operation methods shall all meet the requirements of standards, norms and regulations, and be conducive to quality control.

(5) Environment: there are many environmental factors that affect the quality of project, such as technical environment, labor environment, and natural environment. In addition, measurement, computer software, auxiliary materials, water, electricity and other utilities will also have an impact on quality.

In quality management, man is the decisive factor, which has been recognized by more and more people. The same is true for logistics enterprises. Therefore, we should pay attention to human factors as the basic starting point of quality management. Secondly, from the analysis of the relationship between the five major factors that affect the quality: operator, equipment, raw materials, operation methods and environment, that is, the so-called man, machine, material, method, and environment (4M1E), we should take man as the center. Figure 4.6:

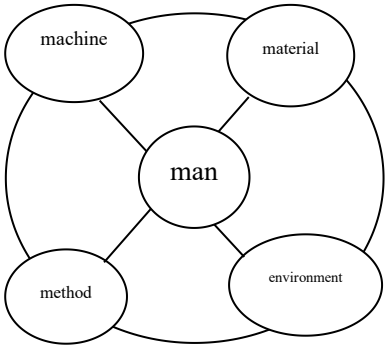

Figure 4.6 Five Factors Affecting Logistics Quality

Source: Wang Fei. Research on Quality Control in Engineering Project Management based on 4M1E [J]. Architectural Knowledge, 2016, (05): 23

However, at present, the implementation of logistics service quality is to strictly ensure the authenticity of assessment indexes through the incentive mechanism for the human resources department and the finance department. At present, an objective and fair automatic assessment system of non-human intervention has not been established in terms of system and information system. Although the current security means of BJ are more effective, for example, wearing a helmet when entering a dangerous place and refusing open fire in a dangerous warehouse, it is mainly because the high-pressure policy of the management department is effective; employees have not formed voluntary behavior, and the concept of total quality management and service management has not been internalized into corporate culture. Therefore, the safeguard is too tough, which increases conflict between employees and management, and the indexes will vary. For example, if the management promotes energy-saving loss, but employees generally waste fuel or electricity, they may fill in the report form at will, resulting in the implementation of indexes cannot continue, and a conflict may arise between the two. There is an urgent need to propose a complete set of logistics service quality assurance measures with people as the center, not only consider the use of rigid constraints of system, but also consider the use of soft constraints of cultural construction to create a good atmosphere of total quality management.

4.4 The Necessity of Improving Quality Evaluation Indexes

At present, many cities in China have put forward the idea of economic transformation, and many areas have also formulated economic transformation plans. Although other regions have not raised the issue of economic transformation, they are actually doing the work of economic transformation. On the whole, the national economic transformation can be divided into the economic transformation of the north and the economic transformation of the south, and there are obvious differences between the economic transformation of the north and south.

The core of economic transformation in the north is the development of alternative industries and successive industries, followed by industrial technology upgrading and economic system innovation. In other words, the economic transformation in the north is dominated by the adjustment of industrial structure and

supplemented by technological progress. The south is the forward position of China's reform and opening up and the core zone of China's economic industrialization and modernization. In spite of this, there is still a gap in production technology and management between the southern economy and the developed economy in the world. Therefore, the core of economic transformation of the south is to promote industrial technological progress and change the mode of economic growth, which is essentially in line with the world economy and participate in world competition. The operation of BJ must also change from lean logistics to high-quality logistics, realize connotative development, improve the rate of resource utilization, better bond with customers, and improve customer satisfaction.

(1) Grasp the current situation of logistics service, find the gap and improve the level.

In order to improve the service quality, logistics enterprises must find out the restrictive factors that affect service quality, which requires an accurate evaluation of the service quality of logistics enterprises. However, the external environment of the enterprise: political, economic, technological, social and other aspects are changing, and the relative competitors of industry are also changing accordingly. In order to survive and develop in such a changing environment, enterprises first of all have their own positioning problems. The environment is changing, and the logistics service evaluation index must also be revised according to the change of environment, so that the assessment index can adapt to the development of environment, and reflect the requirements of suppliers, customers, shareholders, employees, society and other stakeholders to logistics service providers. Only by making the evaluation indexes keep pace with the times, can we truly reflect the ranking and position of BJ in the same industry, so as to provide a basis for finding out the gap and benchmarking advantages.

(2) Construct the performance incentive mechanism and quantify the development goal of the enterprise

As an assessment tool, logistics service quality evaluation system can help enterprises find problems in their own management, so as to point out the direction and target for the follow-up management measures and system reform. However, at

present, the logistics service quality evaluation system of BJ is relatively scattered, and it is not comprehensive and specific enough, which cannot systematically and comprehensively reflect the whole picture of logistics service quality of BJ. Therefore, it is urgent to build a complete and systematic evaluation index system of logistics service quality, quantify the qualitative problems, and give the importance of each index simply and clearly, so as to make logistics enterprises understand the influence of all aspects of service, find out the restrictive factors, improve the service quality in a targeted way, better serve customers, meet customer requirements to win customers' favor and praise.

(3) Build a logistics service platform to promote the transformation and upgrading of enterprises

First-rate enterprises value standards, second-rate enterprises value brands, and third-rate enterprises value products. Third-rate enterprises make products by strengthening the improvement of product quality to gain competitive advantage, but it is difficult to maintain this advantage, which is suppressed and restricted by standards and other big brands. Second-rate enterprises value brands, means that under the standards of industry, brands are established through marketing, strengthening internal management and quality management, and brand advantages need to be cultivated continuously for a long time. But once the industry standards are changed, they need to adapt to the new standards again, which belongs to the competitive advantage of the industry. First-rate enterprises set standards, which goes beyond the concept of branding, that is, after they have gone beyond the stage of establishing a brand, they are widely recognized inside and outside the industry and as the object of trying to imitate and catch up, that is, the target enterprises. What they have made can be used as the direction and reference of peer efforts, and they can also limit the access of other enterprises and weaken the advantages of competitors by raising the threshold and standards.

At the beginning of reform and opening up, BJ joined the logistics industry and stayed in iron and steel logistics industry for more than 20 years. Although it enjoys a certain popularity in the industry, if it wants to pursue excellence and strive for the top, it must participate in the formulation of service quality standards in the logistics industry. To a certain extent, this study will help BJ to transform from a third-party

logistics enterprise to a logistics service supply chain enterprise and then build a logistics service platform.

(4) Participate in international market competition and enhance corporate social responsibility

Iron and steel is a commodity. The internationalization of China's iron and steel circulation is an inevitable trend of economic globalization. For the iron and steel industry, there are two types of enterprises moving towards internationalization, one is iron and steel production enterprises, the other is iron and steel logistics enterprises. Through the optimization and upgrading of steel products, iron and steel production enterprises can improve the scale and quality of steel products and enhance the competitiveness of their products in the international market; besides, they should pay attention to setting up sales organizations overseas and strengthen the promotion of corporate image and products to overseas users. Iron and steel logistics enterprises can cooperate with well-known foreign logistics enterprises and make use of their advanced logistics technology and management concepts to enhance the core competitiveness of enterprises to participate in international trade.

With the implementation of the Belt and Road Initiative[12] strategy, China's logistics industry has ushered in an unprecedented golden period of development. However, most of China's logistics enterprises lack practical experience in going out, which is a severe challenge for China's immature logistics enterprises. In this form, only by strengthening its own connotation construction, high standards and strict requirements, and practicing its internal skills, can BJ improve its service quality, and even improve the development level of China's iron and steel logistics industry, make Chinese logistics enterprises participate in international competition and seize the development opportunity of Belt and Road Initiative.

In addition, it can enhance the awareness of corporate social responsibility, meet the social requirements of corporate environmental protection, green and sustainable

[12] On March 28th, China's National Development and Reform Commission, the Ministry of Foreign Affairs and the Ministry of Commerce jointly issued the Vision and Action for Promoting the Joint Construction of the Silk Road Economic Belt and the 21st Century Maritime Silk Road. The framework is: Belt and Road Initiative is a win-win road for cooperation to promote common development and common prosperity, and a road of peace and friendship to enhance mutual understanding and trust and strengthen all-round exchanges. The Chinese Government proposes to uphold the concepts of peace and cooperation, openness and inclusiveness, mutual learning and mutual benefit, promote practical cooperation in all directions, and build a community of interests, a community with a shared future and a community of responsibility featuring mutual political trust, economic integration and cultural tolerance.
Source: http://www.china.org.cn/chinese/2015-09/15/content_36591064.html

development, and further reduce cost and increase efficiency.

4.5 Chapter Summary

High-quality logistics has become an important link of overall logistics solution for automotive supply chain. Based on lean operation and comprehensive quality management, this thesis studies the economy of main supply chain related links in automobile steel logistics operation. Through empirical research on logistics quality evaluation index of automobile special steel products in BJ, we establish logistics quality evaluation index management standards for automobile special steel products, management and decision of automobile special steel quality logistics quality based on facts and result oriented, which have strong strategic guidance function for automobile specialized steel logistics service work.

First of all, this chapter analyzes the basic background of BJ from three aspects: company development history and business overview, company concept and development model, and company organizational structure. Then it analyzes the current situation and characteristics of the service quality evaluation index of BJ automotive special steel logistics from four aspects: concept and characteristics, positioning and strategy, the implementation of high-quality logistics and service evaluation system. In particular, we conducted a specific analysis of five aspects of the progress of the enterprise: personalization and customization, user adhesion, integration and systematization, refinement, greenness and reversion. Finally, this thesis analyzes the necessity of improving the evaluation index of logistics service quality from four aspects: grasping the current situation of logistics service, finding the improvement of gap, constructing performance incentive mechanism, quantifying enterprise development goal, building logistics service platform, promoting enterprise transformation and upgrading, and participating in international market competition and improving corporate social responsibility.

Through the analysis of the current situation of BJ, we can find that problems to be solved in this study are shown in Table 4.2:

Table 4.2 Problems to be Solved in This Thesis

	Problems to be solved
1	The present situation of BJ's logistics service evaluation system, in what aspects is there a discrepancy between this system and BJ's high-quality logistics development strategy?

2	How to select the logistics service evaluation index scientifically and effectively, so as to better meet the strategic development requirements of high-quality logistics?
3	How to implement the new logistics evaluation system to improve the logistics service level of BJ?

5 Design of Service Quality Evaluation Index for High-quality Logistics of Automobile Special Steel of BJ

High-quality logistics has become an important part of the overall logistics solution of the supply chain of automobile industry. Based on lean operation theory and total quality management, this thesis studies the economy of the main supply chain-related links in the scope of automotive steel logistics operation. The construction of a set of index system and complete service quality evaluation system has become the basis of BJ's decision-making so as to help BJ grasp the current situation of logistics services and find the gap to improve the level; build a performance incentive mechanism to quantify enterprise development goals; build a logistics service platform to promote enterprise transformation and upgrading; participate in international market competition and enhance corporate social responsibility.

Compared with using the whole industry as the research object, this thesis starts with a specific case, which is easier to control and grasp. Although each enterprise has its own uniqueness, as a typical case of the iron and steel logistics industry, the research results of BJ can be applied to enterprises in the same industry, which cannot only promote the development of BJ itself, but also promote the development of the company itself. The details can be shown in figure 5.1.

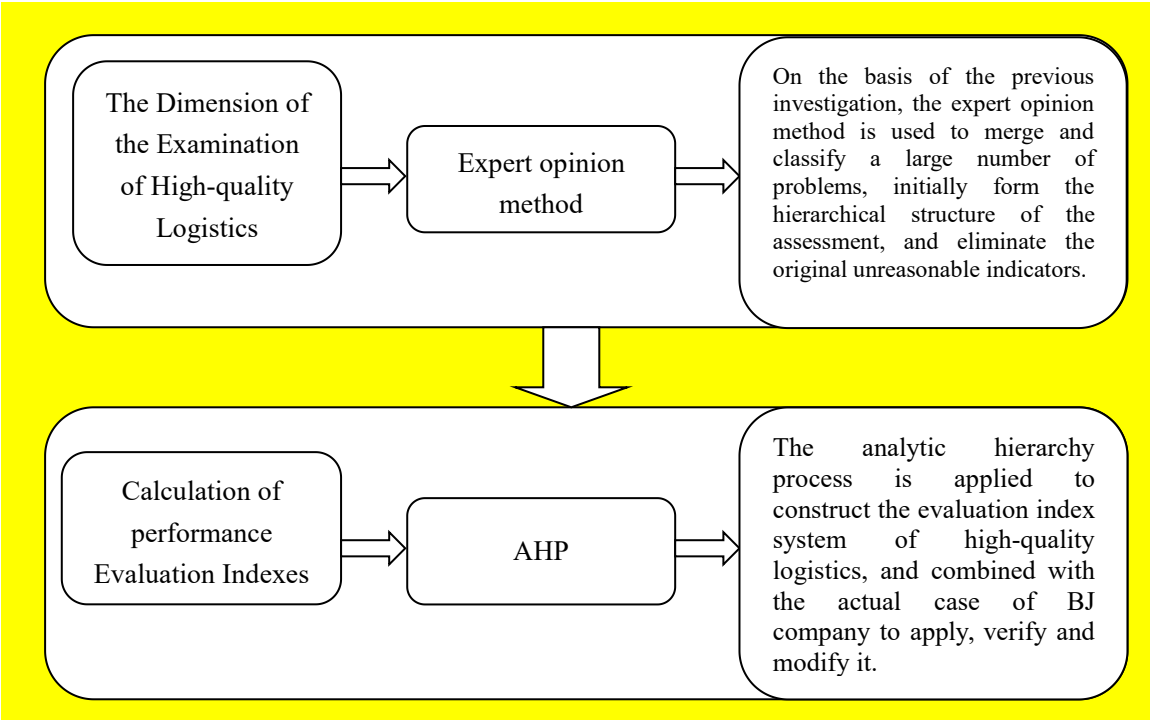

Figure 5.1 Specific Research Methods of this Thesis

At present, from the perspective of quantitative evaluation methods, there are mainly Analytic Hierarchy Process (AHP), Principal Component Analysis (PCA), and Data Envelopment Analysis (DEA).

Table 5.1 Comparison of Commonly Used Quantitative Evaluation Methods of Logistics Performance

Classification	Evaluation Method	Method Principle	Characteristics
Single evaluation method	EVA	Select a single index, calculate the actual value of index, and compare it with the designed standard.	The selected index is relatively single and cannot fully reflect the performance of the evaluation object.
Comprehensive evaluation method	index tree method	The comprehensive performance of the logistics industry is divided into several sub-indexes, and a comprehensive index system is established to reflect the average performance of the logistics industry.	There is a certain one-sidedness to carry on the simple weighted average to the sub-index.
	SFA	Examine the ability to increase	The specific form of

		output under a given input or to reduce input under a given output.	the production function needs to be determined, which is more complex.
	DEA	Examine the ability to increase output under a given input and to live the ability to reduce input under a given output.	There is no need to determine the production function, there is no need to preset the weight of the index, and the evaluation is objective.
	AHP	According to the multi-level characteristics of the logistics system, with the comparison of relative quantities, several judgment matrices are determined, and the eigenvectors corresponding to their eigenvalues are taken as weights, and finally the total weights are synthesized, and the priority is sorted according to them and finally the performance ranking of each logistics unit is gotten.	The reliability is high, the error is small, the evaluation of logistics objects cannot be too many.

However, the above methods need to use more complex mathematical models, which are not suitable for practice. Delphi method has the characteristics of anonymity, multiple feedback and group statistics. It has the following advantages:

(1) It is simple and intuitive, and there is no tedious mathematical model.

(2) Experts can express their opinions independently, and they do not influence each other.

(3) The results obtained by Delphi method synthesize the collective wisdom and are more reliable and accurate.

Therefore, the Delphi method is used in this research, which cannot only combine the practical experience of the practical community and the recent research

results of academic circles, but also help to ensure the innovation and practicality of this assessment index.

Analytic Hierarchy Process (AHP) is a performance evaluation method that combines qualitative and quantitative analysis. The basic principle is to decompose the decision-making problem into different hierarchical structures such as general objectives and sub-objectives of each layer, compare them with each other, finally synthesize the total weight, and then rank the performance. Analytic Hierarchy Process (AHP) has the advantages of systematic, concise and practical, but its disadvantages are: first, the weight is determined by experts, which is easy to be subjectively affected; second, it is not suitable for many indexes and large data statistics, which has certain limitations. The fuzzy comprehensive evaluation method uses a multi-level evaluation model to decompose the indexes at all levels, and gives them different weights according to the contribution of indexes to green logistics performance, and finally forms a complete fuzzy evaluation model. However, to a large extent, the accuracy of the fuzzy comprehensive evaluation method depends on the rationality of selected indexes and weights. The selection of indexes and weights will also be affected by the subjective factors of experts, and the performance evaluation of green logistics often involves more decision-making units, and the excessive set of indexes will reduce the resolution of differences between indexes, resulting in a deviation in weight distribution.

Therefore, this research combines expert opinion method and AHP to achieve the unity of theory and practice.

First of all, according to customer-oriented principle, systematic principle, hierarchical principle, scientific principle and maneuverability principle, combined with the results of customer interview and on-the-spot investigation, on the basis of in-depth analysis of the influencing factors and service characteristics of high-quality logistics service, the service quality evaluation index of BJ automobile special steel high-quality logistics is selected. The evaluation index system is determined by Delphi method, and the weight of each evaluation index is given by Analytic Hierarchy Process (AHP). In order to facilitate the application of logistics service quality evaluation index in the next chapter, a comprehensive evaluation calculation model is built.

5.1 Index System Design

5.1.1 Principles for the Construction of Evaluation Index System

The construction of the logistics service quality evaluation index system of automobile special steel is the research basis of this thesis. Only by designing a scientific index system can we give an accurate evaluation of service quality. In order to ensure the accuracy and objectivity of the service quality measurement of high-quality logistics of automobile special steel, this thesis is based on the characteristics of high-quality logistics service of automobile special steel, follows the basic principle of the construction of evaluation index system, and starts from the practical application value to establish a reasonable evaluation index system of high-quality logistics service quality of automobile special steel. In general, the building principles are based on the following five aspects:

(1) Customer Oriented Principle

Take the customer as the center to establish the automobile special steel high-quality logistics service quality evaluation index system, through the customer perception to evaluate the automobile special steel high-quality logistics service quality, it is helpful for logistics service enterprises to understand its service quality level from the perspective of service recipients, to accurately locate and improve the shortcomings of existing services, so as to better provide customers with more high-quality service. Therefore, in the process of selecting specific evaluation indexes, we should stand from the customer's point of view and complete the construction of the index system with the customer's thinking.

(2) Systematic Principle

The systematicness of the index system means that selected indexes can comprehensively reflect the service quality level of high-quality logistics from different dimensions, which requires not only to pay attention to the comprehensiveness of the index system in the process of index selection, but also to avoid overlap in the content of the index system. In this way, under the premise of considering the relevance of indexes, make them complementary so as to comprehensively grasp the quality level of high-quality logistics services.

(3) Hierarchical Principle

Because the service quality index system of high-quality logistics is a complex system composed of multi-levels and multi-indexes, in the process of constructing the

index system, it can be subdivided according to the level of each index level or the degree of influence, so as to build an intuitive and clear hierarchical index system. In a word, the hierarchical principle can improve the inherent logic of the index system to a great extent.

(4) Scientific Principle

In order to construct a set of scientific and reasonable quality evaluation index system of high-quality logistics service, in the process of determining the evaluation dimension and selecting the index, we must use scientific methods to identify the key indexes in the process of high-quality logistics service. The scientific principle requires that in the process of constructing the index system, we must make an in-depth analysis of factors affecting the service quality of high-quality logistics, and fully refer to the existing relevant theoretical basis and research results to ensure that the index system is constructed scientifically and reasonably.

(5) Operational Principle

There are many factors that affect the service quality of high-quality logistics, and in the actual research process, the more indexes selected, the greater difficulty of data collection and processing will be. Because service quality itself is abstract, in the process of selecting the evaluation index, under the premise of ensuring that the index is consistent with the practical application, indexes with key and clear meaning, which is easy to obtain and calculate, should be extracted as far as possible to realize the feasibility and maneuverability in the evaluation process.

5.1.2 Construction Process of Evaluation Index System

In order to ensure that the quality evaluation index system of high-quality logistics service is scientific and rational, this thesis follows certain procedures and steps in the process of dimension determination and index selection. Based on the results of customer interviews and field investigation, and on the basis of in-depth analysis of influencing factors and service characteristics of high-quality logistics service quality, this thesis takes the dimensional framework of SERVQUAL service quality model as a reference, and obtains a new high-quality logistics service quality evaluation system through appropriate modification, addition, deletion and reinterpretation. The specific construction process is shown in figure 5.1.

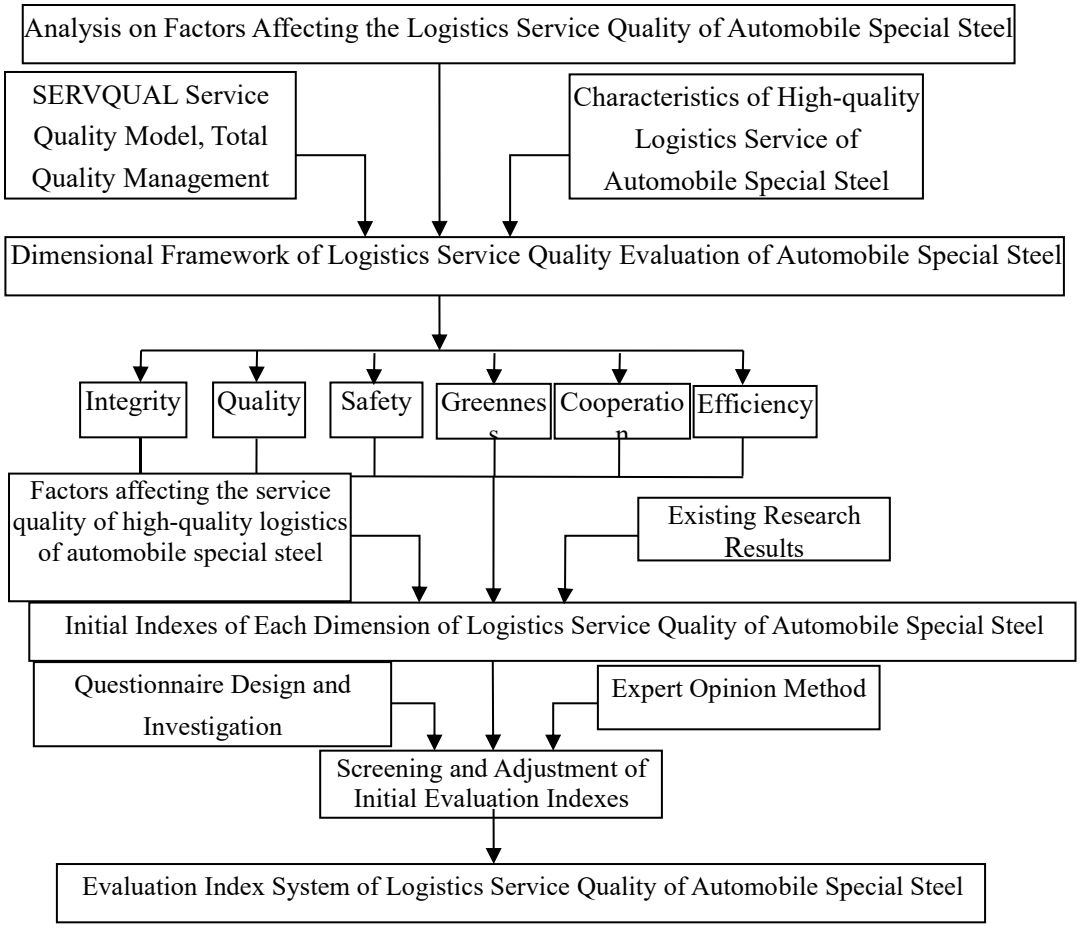

Figure 5.1 Construction Process of Service Quality Evaluation Index System for High-quality Logistics of Automobile Special Steel

Source: the author collates it according to the SERVQUAL service quality model and recent research.

5.2 Index Selection

On the basis of investigation and reference to recent research, the following indexes are used as the basis for assessment.

Table 5.1 Initial Index of Dimension of Logistics Service Quality of Automobile Special Steel

Criterion layer	**Index layer**
A integrity	A1 transport operation plan completion rate. A2 return order timely rate. A3 just-in-time delivery rate. A4 warehousing service delivery error rate. A5 loading and unloading operation plan completion rate. A6 punctual arrival rate. A7 delivery error rate. A8 inventory guarantee.

	A9 liquidation repository
B quality	B1 warehousing damage rate. B2 transportation quality loss rate. B3 unqualified rate of loading and unloading tools. B4 cargo loading and unloading quality loss rate. B5 vehicle operating specification rate. B6 vehicle terminal unexecuted plan accuracy. B7 illegal operation. B8 ship facilities
C safety	C1 completion rate of security inspection of transportation and hoisting equipment. C2 operator qualification. C3 security personnel training completion rate. C4 blind spot completion rate of Civil Air Defense and Technical Defense. C5 timely delivery of orders. C6 hazard source and risk control. C7 implementation of safety and security regulations. C8 safety and environmental protection management
D greenness	D1 defective products and falling objects recovery. D2 recycling of protective materials. D3 identification and control of environmental factors. D4 power loss
E collaboration	E1 user satisfaction. E2 freight information inquiry service. E3 customer service attitude. E4 customer complaint resolution speed. E5 collaboration among all aspects of supply chain. E6 logistics objection claim amount of ten thousand yuan. E7 quality management. E8 operation of management system. E9 timely repair rate of GPS equipment. E10 ship dynamic and timely feedback rate. E11 the number of errors in the use of 3PL system
F efficiency	F1 warehousing cost. F2 transportation cost. F3 circulation processing cost. F4 energy consumption control

Source: the author collates it according to on-the-spot investigation and recent research.

5.3 Construction of Evaluation System

5.3.1 Determination of Evaluation Index System based on Delphi Method

德尔菲 is the Chinese translation of Delphi. In the 1950s, the Rand Company of the United States cooperated with Douglas Company to develop an effective and reliable method of collecting expert opinions, named after Delphi. Since then, this method has been widely used in business, military, education, health care and other fields. In essence, it is a kind of feedback anonymous correspondence method, and its general process is to sort out, summarize and count problems to be predicted, then anonymously feed back to experts, solicit opinions again, concentrate again, and then feedback again, until unanimous opinion is got.

Delphi method has been widely used in evaluation, scientific and technological prediction, determination of influencing factors, medicine, evaluation of intensive land use, ecological environment and sustainable development (Keeney S, Hasson F, & Mckeima H, 2006). See Yuan Qinjian et al. (2011) using Citespace II (Chen. C，2006) to draw the subject knowledge graph of Delphi method in China (figure 5.2).

Figure 5.2 Knowledge Graph of Research Topic of Delphi Method in China

Data sources: Yuan Qinjian, Zong Qianjin, Shen Hongzhou. Research on the Development and Application of Delphi Method in China--Series of Papers of Knowledge Graph Research Group of Nanjing University [J].

Modern Intelligence, 2011, 31 (05): 3-7.

Delphi method has the characteristics of anonymity, multiple feedback and group statistics. It has the following advantages:

(1) It is simple and intuitive, and there is no tedious mathematical model.

(2) Experts can express their opinions independently, and they do not influence each other.

(3) The results obtained by Delphi method synthesize the collective wisdom and are more reliable and accurate.

Therefore, the Delphi method is used in this study, which cannot only combine the practical experience of the practical community and the recent research results of the academic circles, but also help to ensure the innovation and practicality of this assessment index.

(1) Identify a consultative expert group (selection criteria)

When determining experts, Delphi method requires that the research field of experts should be related to this topic, not only have a solid theoretical foundation, but also have a wealth of practical experience. At the same time, the sources of experts must be diverse, and the biases in this field should be different. After analysis and discussion, the study identified eight expert group members, who are researchers from schools, scientific research institutions, and senior managers of logistics enterprises.

Experts must meet the following criteria:

- Age: between 40 and 60.
- Working experience: ≥ 10 years working experience in logistics industry.
- Position: associate professor/senior manager

(2) Draw up an expert consultation form

By referring to the relevant literature, combining the initial indexes of each dimension of the logistics service quality of automobile special steel, the expert consultation questionnaire was drawn up (see Appendix 1), and two rounds of Delphi survey were carried out. The selected index is finally determined according to the boundary value standard.

The questionnaire mainly includes the experts' familiarity with the service quality evaluation index of automobile special steel high-quality logistics, the judgment basis and the degree of importance. Among them, the degree of familiarity and importance is divided into five different grades by Likert scale, and the judgment is divided into practical experience, theoretical basis, reference to domestic and

foreign literature and intuition according to the credibility of content. There is a modification opinion column for each index in the expert consultation table, and experts can modify and supplement the index elements.

(3) Evaluation of consulting experts

① Positive coefficient of experts.

That is, the recovery rate of the consultation questionnaire. The calculation formula is:

Positive coefficient = the number of experts who collected the questionnaire/the number of experts who participated in the consultation.

② The degree of authority of experts.

The formula for calculating the authority degree coefficient of experts is as follows:

Expert authority Cr= (judged by Ca+ familiarity Cs) / 2.

Among them, the quantitative values of judgment basis and familiarity are shown in Table 5.2.

Table 5.2 Quantitative Values of Judgment Basis and Familiarity in the Consultation Table

Judgement basis Ca	Quantitative Value	Familiarity Cs	Quantitative Value
Practical experience	0.8	Very familiar	1
Theoretical analysis	0.6	familiar	0.8
Refer to domestic and foreign literature	0.4	Generally familiar	0.6
Intuition	0.2	Not very familiar	0.4
		Not familiar	0.2

According to the requirements of statistics, there is a positive correlation between the authority of experts and the accuracy of prediction. the higher the degree of authority of experts, the more accurate the prediction results will be. General speaking, experts think that Cr ≥ 0.70 is acceptable reliability.

③ The acceptance reliability of the coordination coefficient of expert opinions.

The coordination coefficient W refers to the degree of coordination of the opinions of all experts on indexes at all levels, which reflects whether the experts' opinions are consistent or not. The calculation formula is:

$$W = \frac{12}{n^2\left(m^3 - 31\right) - n\sum_i T_i} \sum_{j=1}^{m} d_j^2$$

In the formula, W represents the coordination coefficient, m represents the

number of indexes, n represents the number of experts, dj represents the average deviation, Ti is the correction coefficient, $T_i = \sum(A_i^3 - A_i)$, Ai represents the number of indexes for each expert to give the same grade. The difference significance test of coordination coefficient is X2 test, $X^2 = n(m-1)^w/2$, in which the P value is less than 0.05, which shows that the expert evaluation opinion is well coordinated and the result is desirable.

(4) Methods and standards of index screening

The index screening uses the boundary value method and combined with expert advice to screen the evaluation index. The method of setting the boundary value is to calculate the arithmetic mean, the full score frequency and the coefficient of variation according to the score of each index, which has three judgment scales. In order to avoid the elimination of important indexes, if the three scales do not meet the boundary criteria, they are excluded. For one or two indexes that do not meet the requirements, the indexes should be adjusted according to principles of science, comprehensiveness and feasibility, and the revised opinions put forward by experts should be fully taken into account. The three judgment criteria and screening criteria of the index are:

① Arithmetic mean

$$M_j = \frac{1}{n}\sum_{i=1}^{n} C_{ij}$$

In the above formula, n represents the number of experts and C_{ij} represents the total value of the score of the j index by the I expert. The higher the value of the arithmetic mean M_j, the higher the importance of the corresponding j index. Among them, the boundary value of the arithmetic mean is calculated as follows: the boundary value = the mean-standard deviation of the arithmetic mean. If the arithmetic mean of a single index is higher than the boundary value, the index is selected.

② Full score rate

$$K_j = \frac{m_j'}{m_j}$$

In the formula, m_j indicates the number of experts who participate in the evaluation of the j, m_j' indicates the number of experts who give the index a full score of importance to M_j. The value of the full score rate K_j is between 0 and 1, K_j can be used as a supplementary index. The larger K_j is, indicating that the greater the proportion of experts who give full marks to the index, and the more important the index is. Among them, the boundary value of the full score frequency is calculated as follows: the boundary value = the mean-standard deviation of the full score frequency. If the full score frequency of a single index is higher than the boundary value, the index is selected.

③ Coefficient of variation

$$V_j = \frac{P_j}{M_j}$$

In the formula, P_j is the standard deviation of the j th index, M_j is the arithmetic mean of the j th index. The coefficient of variation indicates the degree of coordination of experts on the relative importance of the j index. The smaller the coefficient of variation V_j is, the higher the degree of coordination of experts is. Among them, the boundary value of the coefficient of variation is calculated as follows: the boundary value = the mean of the coefficient of variation+standard deviation. If the coefficient of variation of a single index is lower than the boundary value, the index is selected.

In this study, SPSS 22.0 was used for statistical analysis, and the calculated values were experts' positive coefficient, authority coefficient and coordination coefficient, average, standard deviation, and coefficient of variation.

(5) Results and discussion

① Positive coefficient of experts

In the first round of Delphi consultation, a total of 8 experts were sent questionnaires and seven valid data were collected. In the second round of Delphi consultation, a total of seven questionnaires were distributed, with a recovery rate of 100%. The specific data are shown in Table 5.3.

Table 5.3 Recovery of Delphi Questionnaire

Round	Send out a questionnaire	Recover the questionnaire	Recovery rate	Valid questionnaire	Valid rate	Make suggestions	Account for the number of experts
Round 1	8	7	87.5%	7	100%	6	85.7%
Round 2	7	7	100%	7	100%	2	28.6%

If the recovery rate of the expert consultation form is 50% or more, the data can be used for analysis and reporting. Among them, 60% of the recovery rate is good, 70% is very good. The recovery rates of this study are 87.5% and 100% respectively, which meet the sample recovery index required by Delphi method. At the same time, it also reflects that the enthusiasm of consulting experts is relatively high, and it is concerned and supported for the construction of service quality evaluation index of automobile special steel high-quality logistics. The proportion of experts making suggestions in the table is 85.7% and 28.6% respectively. On one hand, it reflects the enthusiasm of the experts from the side; on the other hand, it reflects that after the first round of index revision, the experts have fewer objections to the indexes and tend to agree.

② The degree of authority of an expert

The degree of authority of experts is completed by the self-evaluation of experts, which collects the judgment basis and familiarity of experts to the elements of each index. Taking the authority degree coefficient of the first-level index as an example, the specific results are shown in Table 5.4.

Table 5.4 Coefficient of Authority of First-level Indexes

First-level index	Judgment basis C_a	Familiarity C_S	Degree of authority Cr
Integrity	0.68	0.9	0.79
Quality	0.8	0.9	0.85
Safety	0.8	0.95	0.875
Greenness	0.76	0.95	0.855
Collaboration	0.76	0.9	0.83
Efficiency	0.76	0.92	0.84
Average value	0.76	0.92	0.84

According to statistical experience, the degree of expert authority Cr≥0.7 is

acceptable. From the coefficient of the first-level index, we can see that the degree of authority of each item is more than 0.7, and the average value is 0.84. According to the functional relationship between the degree of expert authority and accuracy, the prediction accuracy of this research is high, the data can be used for analysis, and the results are credible.

③ Coordination coefficient of experts

Table 5.5 Coordination Coefficient of Delphi Expert Opinion

Correlation coefficient	Round 1	Round 2
Coordination coefficient W	0.379	0.490
X^2	118.283	161.628
P	0.000	0.000

The coordination coefficient of expert opinions reflects the consistency of different experts' opinions on the importance of each index, and it is also an important index that the consultation results are reliable. The coordination coefficient W is between 0 and 1, and the larger the W is, the better the coordination degree is. The general coordination coefficient fluctuates in the range of 0.5. Table 4.5 shows the relevant data on the coordination coefficient of two rounds of consultation. The coordination coefficients of two rounds of consultation are 0.379 and 0.490 respectively, indicating that the coordination of experts is getting higher with the increase of the number of rounds. Among them, the test value of coordination coefficient P is 0.000, which reflects that experts' understanding of the importance of evaluation indexes at all levels tends to be consistent, and the results are desirable and reliable.

The initial construction of a total of 50 quality logistics evaluation indexes, including 6 first-level indexes and 44 second-level indexes. The indexes were adjusted according to the opinions of experts in two rounds of consultations, including the rating of importance and the recommendations of indexes at all levels. After two rounds of questionnaire consultation, expert opinions tend to be consistent, and finally determine a total of 42 evaluation indexes, including 6 first-level indexes and 36 second-level indexes. The average number of indexes and the value of coefficient of variation in the first round of Delphi expert consultation are shown in Table 4.6. Among them, the boundary value is calculated as follows:

First, the boundary value of arithmetic average: 4.46-0.34-4.12 (where 4.46 is the average of arithmetic average of all levels of indexes, and 0.34 is the standard

deviation). If the value of each index is higher than the boundary value, the index is selected.

Second, the cutoff value of the full score frequency is 0.58-0.2700.31 (where 0.58 is the average of the full score frequency and 0.27 is the standard deviation). If the value of each index is higher than the boundary value, the index is selected.

Third, the boundary value of coefficient of variation is 0.12-0.08-0.20 (in which 0.12 is the average value of coefficient of variation and 0.08 is standard deviation). If the income value of each index is lower than the boundary value, the index is selected.

Table 5.6 Correlation Coefficient of Each Evaluation Index Element in the Questionnaire

Index	Arithmetic mean	Full score frequency	Variation Coefficient	Indexes	Arithmetic mean	Full score frequency	Variation Coefficient
A	4.33	0.50	0.19	C6	4.50	0.50	0.15
A1	4.50	0.50	0.12	C7	4.50	0.67	0.18
A2	4.15	0.35	0.17	C8	4.01	0.30	0.13
A3	4.11	0.32	0.19	D	4.33	0.33	0.12
A4	5.00	1.00	0.00	D1	4.33	0.50	0.19.
A5	4.50	0.50	0.12	D2	4.33	0.67	0.19
A6	3.66	0.17	0.22	D3	4.40	0.41	0.16
A7	4.02	0.20	0.23	D4	4.16	0.50	0.15
A8	4.66	0.67	0.11	E	4.33	0.33	0.12
A9	4.33	0.33	0.12	E1	4.51	0.33	0.19
B	4.67	0.67	0.11	E2	5.00	1.00	0.00
B1	4.50	0.67	0.18	E3	4.01	0.29	0.21
B2	4.33	0.50	0.19	E4	4.50	0.67	0.18
B3	4.50	0.50	0.12	E5	4.50	0.67	0.18
B4	4.30	0.33	0.19	E6	4.13	0.32	0.19
B5	4.33	0.67	0.11	E7	4.12	0.33	0.22
B6	4.50	0.50	0.12	E8	4.10	0.30	0.17
B7	4.00	0.80	0.21	E9	4.13	0.34	0.19
B8	4.11	0.56	0.22	E10	4.11	0.30	0.21
C	4.50	0.67	0.18	E11	4.23	0.32	0.19
C1	4.66	0.50	0.15	F	5.00	1.00	0.00

C2	4.16	0.33	0.17	F1	4.62	0.35	0.19
C3	4.33	0.33	0.11	F2	4.43	0.34	0.17
C4	4.50	0.67	0.18	F3	4.34	0.35	0.19
C5	3.78	0.30	0.22	F4	4.82	0.33	0.14

As can be seen from Table 5.6:

First, the indexes that do not meet the cutoff criteria on the three scales are: A6-punctual arrival rate, A7-delivery error rate, B7-illegal operation, B8-ship facilities, C5-delivery order just-in-time rate, E3-customer service attitude, E10-ship dynamic and timely feedback rate. Therefore, according to expert opinion, the above seven items will be deleted.

Second, two indexes do not meet the boundary value standard: C8 ~ E8. C8 refers to safety and environmental protection management, the description is too general, does not reflect the specific problems, and needs to be eliminated. E8 refers to the operation of the management system, which duplicates the quality management of E7 and is therefore excluded.

Third, there is an index that the scale does not meet the boundary value standard is: A3, E1, E7. Among them, A3-timely delivery rate is adjusted to planned on-time completion rate according to expert opinion. E1-user satisfaction, which is too general, shall be adjusted to user complaint rate according to expert opinion. E7-quality management, which is also too general, shall be adjusted to process monitoring coverage according to expert opinion.

Fourth, in addition,in consideration of expert opinions, changes to the following indexes need to be made. The specific adjustments include: A8-inventory guarantee, the expression is not accurate enough, adjusted to inventory guarantee rate; A9-liquidation warehouse, the expression is more general, adjusted to just-in-time rate of liquidation warehouse; C2 operator qualification, the expression is not clear enough, adjusted to operator qualification standard rate; C6 hazard sources and risk control, the statement is not clear enough, adjusted to hazard sources and risk control coverage. C7 the implementation of safety and security regulations is not accurate enough, adjusted to enforcement rate of safety and security regulations; D1, the recovery of defective products and falling objects is not accurate enough, and adjusted to recovery rate of defective products and falling objects; D2 protective materials are recycled, expressed in general terms, and adjusted to recycling utilization rate of protective

materials. D3 environmental factors identification and control, too general, removed according to expert opinions, and changed to steel plant-automobile plant-steel plant closed-loop return rate; E2 freight information query service, too general, changed to freight information query service coverage; E5 supply chain collaboration, inaccurate expression, changed to supply chain collaboration rate.

After the first round of indexes adjustment, the second round of expert opinions tend to be consistent, and the final revised indexes are compared with the initial indexes as shown in Table 5.7.

Table 5.7 Comparison between Initial Index and Final Index of Service Quality Evaluation of High-quality Logistics of Automobile Special Steel

Criterion layer	**Initial Index Layer**	**Final Index Layer**
A integrity	A1 Transport operation plan completion rate. A2 return order timely rate. *A3 just-in-time delivery rate.* A4 warehousing service delivery error rate. A5 loading and unloading operation plan completion rate. **A6 punctual arrival rate.** **A7 delivery error rate.** *A8 inventory guarantee.* *A9 liquidation repository*	A1 Transport operation plan completion rate. A2 return order timely rate. *A3 plan on-time completion rate.* A4 warehousing service delivery error rate. A5 loading and unloading operation plan completion rate. *A8 inventory guarantee rate.* *A9 just-in-time rate of liquidation*
B quality	B1 warehousing damage rate. B2 transportation quality loss rate. B3 unqualified rate of loading and unloading tools. B4 cargo loading and unloading quality loss rate. B5 vehicle operating specification rate. B6 vehicle terminal unexecuted plan accuracy. **B7 illegal operation.** **B8 ship facilities**	B1 warehousing damage rate. B2 transportation quality loss rate. B3 unqualified rate of loading and unloading tools. B4 cargo loading and unloading quality loss rate. B5 vehicle operating specification rate. B6 vehicle terminal unexecuted plan accuracy.
C	C1 completion rate of security	C1 completion rate of security inspection

safety	inspection of transportation and hoisting equipment. *C2 operator qualification.* C3 security personnel training completion rate. C4 blind spot completion rate of Civil Air Defense and Technical Defense. **C5 timely delivery of orders.** C6 hazard source and risk control. *C7 implementation of safety and security regulations.* **C8 safety and environmental protection management**	of transportation and hoisting equipment. *C2 operator qualification.* C3 security personnel training completion rate. C4 blind spot completion rate of Civil Air Defense and Technical Defense. C6 hazard source and risk control. *C7 implementation of safety and security regulations.*
D greenness	D1 defective products and falling objects recovery. D2 recycling of protective materials. *D3identification and control of environmental factors.* *D4 power loss*	D1 defective products and falling objects recovery. D2 recycling of protective materials. *D3 steel plant-automobile plant-steel plant closed loop return rate.* *D4 power loss (kilowatt-hour / ten thousand yuan)*
E Collaboration	E1 user satisfaction. E2 freight information inquiry service. **E3 customer service attitude.** E4 customer complaint resolution speed. *E5 Collaboration among all aspects of supply chain.* E6 logistics objection claim amount of ten thousand yuan. *E7 quality management.* **E8 operation of management system.** E9 timely repair rate of GPS equipment.	E1 user complaint rate. E2 freight information inquiry service. E4 customer complaint resolution speed. *E5 Collaboration rate of each link of supply chain.* E6 logistics objection claim amount of ten thousand yuan. *E7 process monitoring coverage.* E9 timely repair rate of GPS equipment. E11the number of errors in the use of 3PL system

	E10 ship dynamic and timely feedback rate. E11 the number of errors in the use of 3PL system	
F efficiency	F1 warehousing cost. F2 transportation cost. F3 circulation processing cost. F4 energy consumption control	F1 warehousing cost. F2 transportation cost. F3 circulation processing cost. F4 energy consumption control

Note: (1) bold is deleted index; (2) italic is initial index-final index modification.

The final evaluation index system is shown in Table 5.8.

Table 5.8 Final Index of Logistics Service Quality Evaluation of Automobile Special Steel

Criterion layer	**Initial index layer**
A integrity	A1 transport operation plan completion rate. A2 return order timely rate. A3 plan on-time completion rate. A4 warehousing service delivery error rate. A5 loading and unloading operation plan completion rate. A6 inventory guarantee rate. A7 just-in-time rate of liquidation repository
B quality	B1 warehousing damage rate. B2 transportation quality loss rate. B3 unqualified rate of loading and unloading tools. B4 cargo loading and unloading quality loss rate. B5 vehicle operating specification rate. B6 vehicle terminal unexecuted plan accuracy
C safety	C1 completion rate of security inspection of transportation and hoisting equipment. C2 operator qualification standard rate. C3 security personnel training completion rate. C4 blind spot completion rate of civil air defense and technical defense. C5 hazard source and risk control. C6 implementation rate of safety and security regulations
D greenness	D1 defective products and falling objects recovery. D2 recycling of protective materials. D3 steel plant-automobile plant-steel plant closed loop return rate. D4 power loss (kilowatt-hour/ten thousand yuan)
E	E1 user complaint rate.

collaboration	E2 freight information inquiry service. E3 customer complaint resolution speed. E4 collaboration rate of each link of supply chain. E5 logistics objection claim amount of ten thousand yuan. E6 process monitoring coverage. E7 timely repair rate of GPS equipment. E8 the number of errors in the use of 3PL system
F efficiency	F1 warehousing cost. F2 transportation cost. F3 circulation processing cost. F4 energy consumption control

In short, the final evaluation system deletes indexes that are difficult to measure, and those that are not accurate enough, making the whole evaluation system more feasible and practical.

In this study, the reliability and validity of the research are discussed in detail.

1 Positive coefficient of experts.

If the recovery rate of the expert consultation form is 50% or more, the data can be used for analysis and reporting. Among them, 60% of the recovery rate is good, and 70% is very good. The recovery rates of this study are 87.5% and 100% respectively, which meet the sample recovery index required by Delphi method.

2 The degree of authority of experts.

According to statistical experience, the degree of expert authority Cr≥0.7 is acceptable. From the coefficient of the first-level index, we can see that the degree of authority of each item is more than 0.7, and the average value is 0.84. According to the functional relationship between the degree of expert authority and this accuracy, the prediction accuracy of this study is high, the data can be used for analysis, and the results are credible.

(3) The coordination coefficient of experts.

The coordination coefficient of expert opinions reflects the consistency of different experts' opinions on the importance of each index, and it is also an important index that the consultation results are reliable. The coordination coefficient W is between 0 and 1, and the larger the W is, the better the coordination degree is. The general coordination coefficient fluctuates in the range of 0.5.

The coordination coefficients of the two rounds of consultation in this research are 0.379 and 0.490 respectively, indicating that the coordination of experts is getting

higher with the increase of the number of rounds. Among them, the test value of coordination coefficient P is 0.000, which reflects that experts' understanding of the importance of evaluation indicators at all levels tends to be consistent, and the results are desirable and reliable.

5.3.2 Study on Weights of Evaluation Index System based on AHP

Analytical Hierarchy Process (AHP) proposed by American Operational Researcher A.L.Saaty in the 1970s is a decision analysis method combining qualitative and quantitative methods (Duan Qiuan, 2015). It is a process of modeling and quantifying decision thinking processes for decision makers to handle complex systems (Yuan Jixue, 2010).

Applying this method, decision makers can calculate weights of different schemes by decomposing complex problems into several levels and several factors, which can provide basis for choosing optimal schemes.

The basic principle of Analytic hierarchy process (AHP): the AHP method first hierarchically divides the problem into different levels according to the nature of the problem and the general goal, forming a multi-level analytical structure model, which is divided into the lowest level (schemes and measures for decision-making), relative to the determination of the relative importance weights of the highest level (total objectives) or the ranking of relative advantages and disadvantages.

AHP features:

- Clearly analyzed ideas can train the thinking process of analysts in a systematic, mathematical and modeling way;
- Quantitative data needed for analysis are not enough, but require specific and explicit factors and relationships contained in them;
- This method applies to decision analysis of multi-criteria and multi-objective complex problems, widely used in regional economic development schemes comparison, scientific achievements evaluation, resource planning and analysis and enterprise personnel quality assessment.

Different evaluation indexes have different contributions to the overall goal of system evaluation, that is, the importance of evaluation indexes is different. The index weight is to reflect the proportion of each evaluation index in the overall goal of the system in a quantitative way. In the system evaluation, it is necessary to determine not

only the weight of each category of indexes, but also the relative weight of individual evaluation indexes relative to large categories of indexes. When determining the weight, we should pay attention to the consistency of the importance of the indexes to avoid the logical confusion between the indexes. If A is more important than B and B is more important than C, then it is logical that A is more important than C. If C is more important than A, there is logical confusion. The determination of index weight is the core of effect evaluation and a difficult task in system comprehensive evaluation, which often needs to be adjusted and summarized repeatedly as a whole. The methods that can be applied are: expert consultation method, Analytic Hierarchy Process (AHP), Principal Component Analysis (PCA), and Grey Relational Degree Analysis. At present, most studies use the combination of expert consultation method and Analytic Hierarchy Process, which cannot only make full use of the historical experience and professional knowledge of experts, but also ensure the objectivity of evaluation to a certain extent on the basis of mathematical tools, so this method is adopted in this thesis.

(1) The Process of Constructing Index System by Analytic Hierarchy Process

According to the above evaluation index system of high-quality logistics service of automobile special steel, the weight of index element is determined by Analytic Hierarchy Process (AHP). First of all, according to the evaluation framework, the experts consult the questionnaire, collect the data and information of each expert in the expert group to judge the relative importance of indexes at all levels, and then further use the judgment matrix obtained by the pairwise comparison of indexes to calculate the final results. The process is as follows:

① according to the framework of logistics service quality evaluation system of automobile special steel, a questionnaire is designed for pairwise comparison of indexes at all levels；

② experts are invited to score the relative importance of indexes at all levels according to the scale of relative importance in Analytic Hierarchy Process (AHP)；

③ collect the questionnaire data of each expert, and process and analyze the data. The specific steps are as follows:

Consultative expert group (selection criteria):

When determining experts, AHP method requires that the research field of experts should be related to this topic, not only have a solid theoretical foundation, but

also have a wealth of practical experience. At the same time, the sources of experts must be diverse, and the biases in this field should be different. After analysis and discussion, the research identified six expert group members, who are researchers from schools, scientific research institutions, and senior managers of logistics enterprises.

The specific steps are as follows:

Step 1: Construct the Comparison Matrix A

The method of pairwise comparison of all levels of indexes is used to construct the judgment matrix, and each number represents the relative importance. The scale and description are shown in Table 5.7:

Table 5.7 Scale of Relative Importance

Importance level（± represents positive and negative values）	Meaning	Description
1	Equally important	The comparison of the two indexes shows that they are equally important.
±3	Slightly important	Comparing the two indexes, +3 means that the index on the left is slightly more important than that on the right;-3 means that the index on the right is slightly more important
±5	Comparatively important	Comparing the two indexes, +5 means that the index on the left is more important than that on the right;-5 means that the index on the right is more important than that on the left
±7	Very important	Comparing the two indexes, +7 means that the index on the left is much more important than that on the right;-7 means that the index on the right is much more important than that on the left.
±9	Absolutely important	Comparing the two indexes, +9 means that the index on the left is absolutely more important than that on the right;-9 means that the index on the right is absolutely more important than that on the
±2、±4、±6、±8	——	The intermediate value of the above adjacent judgment

Note: in the process of constructing a matrix, the number of the positive value is still positive in the matrix, and the negative value needs to be converted into the reciprocal of the absolute value of the number in the matrix, for example,-3 is represented as 1/3 in the matrix.

Step 2: Maximum Eigenvalue and Eigenvector

After the judgment matrix is constructed from the data information of experts, the eigenvector and the maximum eigenvalue of matrix are calculated. The square root method λ_{max} and its corresponding eigenvectors are studied, and the specific calculation process is as follows:

①The n-th root of the product of each row of the judgment matrix A is calculated, and the initial weight vector is obtained：

$$W_i = \frac{W_i'}{\sum_{i=1}^{n} W_i'}$$

② Object quantity is normalized：

$$W_i' = \sqrt[n]{\prod_{i=1}^{n} a_{ij}}$$

Then $W = (W_1, W_2, \cdots W_n)^T$ is the weight sort vector.

③Maximum eigenvalue

$$\lambda_{max} = \frac{1}{n}\sum_{i=1}^{n}\frac{(AW)_i}{W_i}$$

Among them，$(AW)_i$ represents the ith element of a vector AW.

Step 3: Check the consistency of judgment matrix

Generally speaking, it is not necessary to satisfy the absolute consistency in the constructed judgment matrix. That is, the Analytic Hierarchy Process does not require the judgment matrix be completely consistent, but the general trend of judgment needs to be consistent. For example, when judging the importance of elements A, B and C, A is 2 points more important than B, and A is 3 points more important than C. if B is 1 point more important than C, then the matrix is completely consistent; if C is 2 points more important than B, it obviously does not meet the requirements. In order to prevent the consistency deviation from being too large, it is necessary to judge whether the matrix is within the error range by consistency test. the test methods are as follows:

① Consistency inspection index

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

② Average random consistency index RI

The value of RI varies with the order of the matrix, and the specific value of RI is shown in Table 5.8.

Table 5.8 Average Random Consistency index RI Standard Value

Degree n	1	2	3	4	5	6	7	8	9
RI	0	0	0.52	0.89	1.12	1.26	1.36	1.41	1.46

③ Find out the relative consistency test coefficient

$$CR = CI/RI$$

When the judgment matrix A $CR < 0.1$ or $\lambda_{max} = n$, it shows that the comparison matrix has good consistency and is acceptable, otherwise the judgment matrix needs to be modified.

(2) Determination of Weight of Evaluation Index System

According to the collected expert questionnaire data about the pairwise comparison of indexes, the data are quantified by Maxi-Analytic Hierarchy Process professional software, and the relevant values of weights are calculated and analyzed.

Based on the questionnaire data of expert 1, the judgment matrix of the first-level index is shown in Table 5.9.

Table 5.9 Judgment Matrix of Expert 1 to First-level Index

First-level index	A integrity	B quality	C safety	D greenness	E collaboration	F efficiency
A integrity	1	1/2	1/1	4	5	2
B quality	2	1	1/1	5	5	3
C safety	1	1	1	3	5	5
D greenness	1/4	1/5	1/3	1	1/3	1/5
E collaboration	1/5	1/5	1/5	3	1	1/5
F efficiency	1/2	1/3	1/5	5	5	1

From this, we can get: $\lambda_{max} = 6.60376$, RI=1.26, n=6, then

$$CI = \frac{\lambda_{max} - n}{n-1} = \frac{6.6038 - 6}{6-1} = 0.1208$$

$CR = CI/RI$=0.1208/1.26=0.0958<0.1，Consistency meets the basic requirements.

The maximum eigenvalue vector (weight) after normalization is 0.2041, 0.2861, 0.2658, 0.0472, 0.0605, 0.1363.

By repeating above steps, weight and consistency test value of each expert for the first-level index evaluation are obtained. For the expert data that failed in part of the consistency test, the data is corrected. After correction, the data information of each expert is CR≤0.1, and the consistency test meets the requirements. The average weight coefficient of the same index of all experts is calculated, and the final weight of the concentrated opinion of the expert group is obtained.

$W_A = 0.2018$，$W_B = 0.2717$，$W_C = 0.2483$，$W_D = 0.0534$，$W_E = 0.0983$，$W_F = 0.1265$

According to the same calculation method, the data information of the secondary index is calculated, and the weight ratio of the secondary index is obtained. The weights of primary and secondary indexes are shown in Table 5.10.

Table 5.10 Weight coefficients of primary and secondary indexes for logistics service quality evaluation of automobile special steel

First-level Index	Weight	Secondary Index	Peer Weight	Global Weight (conclusion value)
A integrity	0.2018	A1 transport operation plan completion rate	0.1737	0.0351
		A2 return order timely rate	0.0906	0.0182
		A3 plan on-time completion rate	0.1355	0.0273
		A4 warehousing service delivery error rate	0.3239	0.0654
		A5 loading and unloading operation plan completion rate	0.1348	0.0272
		A6 inventory guarantee rate	0.1103	0.0223
		A7 just-in-time rate of liquidation repository	0.0312	0.0063
B quality	0.2717	B1 warehousing damage rate	0.1904	0.0517
		B2 transportation quality loss rate	0.3343	0.0908
		B3 unqualified rate of loading and unloading tools	0.0702	0.0192
		B4 cargo loading and unloading	0.1875	0.0509

		quality loss rate		
		B5 vehicle operating specification rate	0.0754	0.0205
		B6 vehicle terminal unexecuted plan accuracy rate	0.1422	0.0386
C safety	0.2483	C1 completion rate of security inspection of transportation and hoisting equipment	0.0903	0.0224
		C2 operator qualification standard rate	0.1338	0.0332
		C3 security personnel training completion rate	0.0770	0.0191
		C4 blind spot completion rate of civil air defense and technical defense	0.3185	0.0791
		C5 hazard source and risk control	0.2350	0.0584
		C6 implementation rate of safety and security regulations	0.1454	0.0361
D greenness	0.0534	D1 defective products and falling objects recovery	0.1549	0.0083
		D2 recycling of protective materials	0.2397	0.0128
		D3 steel plant-automobile plant-steel plant closed loop return rate	0.1862	0.0099
		D4 power loss (kilowatt-hour/ten thousand yuan)	0.4192	0.0224
E collaboration	0.0983	E1 user complaint rate	0.1852	0.0182
		E2 freight information inquiry service	0.0664	0.0065
		E3 customer complaint resolution speed	0.0850	0.0084
		E4 collaboration rate of each link of supply chain	0.2102	0.0207
		E5 logistics objection claim amount of ten thousand yuan	0.1966	0.0193
		E6 process monitoring coverage rate	0.0508	0.0050
		E7 timely repair rate of GPS equipment	0.0401	0.0039
		E8 the number of errors in the use of	0.1657	0.0163

		3PL system		
F efficiency	0.1265	F1 warehousing cost	0.2675	0.0338
		F2 transportation cost	0.4843	0.0613
		F3 circulation and processing cost	0.0846	0.0107
		F4 energy consumption control	0.1636	0.0207

(3) Analysis and discussion on the rationality of weight

① Analysis on the rationality of weight distribution of first-level index

The weights of the first-level index items: A integrity, B quality, C safety, D greenness, E coordination and F efficiency are 0.2018, 0.2717, 0.2483, 0.0534, 0.0983, 0.1265 respectively. It can be seen that among the first-level indexes of quality logistics service quality evaluation of automobile special steel, the proportion of quality weight is the largest, indicating that quality is the most concerned with the quality of high-quality logistics service quality evaluation.

Secondly, the proportion of safety weight is the second most important, indicating that safety is also an extremely important factor in the service quality of high-quality logistics. The third is integrity and efficiency, which is also an important issue in the quality of high-quality logistics service.

② Analysis on the rationality of weight distribution of second-level index

The second-level indexes under A integrity: A1 transportation operation plan completion rate, A2 return order just-in-time rate, A3 plan on-time completion rate, A4 warehousing service delivery error rate, A5 loading and unloading operation plan completion rate, A6 inventory guarantee rate, A7 liquidation warehouse just-in-time rate, the weights are (0.1737, 0.906, 0.1350.3239, 0.1348,0.1103, 0.0312, respectively), among which the error rate of A4 warehousing service delivery is the most important. The second is A1 transportation operation plan completion rate, A3 plan on-time completion rate, and A5 loading and unloading operation plan completion rate.

The second-level indexes under B quality: B1 storage damage rate, B2 transport quality loss rate, B3 loading and unloading tool unqualified rate, B4 cargo loading and unloading quality damage rate, B5 vehicle operation specification rate, B6 vehicle terminal non-implementation plan accuracy rate, the weights are 0.1904, 0.3343, 0.0702, 0.1875, 0.0754, 0.1422 respectively. Among them, B2 transportation quality loss rate accounts for the highest weight, followed by B1 storage cargo damage rate, B4 cargo loading and unloading quality loss rate, followed by B6 vehicle terminal

non-implementation plan accuracy.

The second-level index under C safety: C1 transportation and hoisting equipment security inspection completion rate, C2 operator qualification standard rate, C3 safety personnel training completion rate, C4 civil air defense, technical defense blind spot completion rate, C5 hazard and risk control, C6 safety and security regulations enforcement rate, the weight is 0.0903 0.1338 0.0770 0.3185 0.2350 0.1454). The weight is 0.0903, 0.1338, 0.0770, 0.3185, 0.2350, 0.1454, respectively (0.0903, 0.1338, 0.0770, 0.3185, 0.2350, 0.1454). Among them, C4 civil air defense, technical defense blind spot completion rate accounted for the highest weight, followed by C5 hazard sources and risk control, followed by C6 safety and security regulations implementation rate, C2 operator qualification rate.

The second-level index under D greenness: D1 recovery of defective products and falling objects, D2 recycling of protective materials, D3 closed-loop return rate of steel plant-automobile plant-steel plant, D4 power loss (kWh/10,000yuan), the weights are 0.1549, 0.2397, 0.1862, 0.4192 respectively. Among them, D4 power loss (kWh/10,000 yuan) accounted for the highest proportion, followed by D2 protective material recycling accounted for the highest proportion, followed by D3 steel plant-automobile plant-steel plant closed-loop return rate.

The second-level indexes under E collaboration: E1 customer complaint rate, E2 freight information query service, E3 customer complaint resolution speed, E4 supply chain collaboration rate, E5 logistics objection ten thousand yuan claim amount, E6 process monitoring coverage rate, E7 GPS equipment timely repair rate, E8 3PL system use error number. The weights are 0.1852, 0.0664, 0.0850, 0.2102, 0.1966, 0.0508, 0.0401, 0.1657). Among them, the weight of collaboration rate of each link of E4 supply chain is the highest, followed by E5 logistics objection ten thousand yuan claim, E1 user complaint rate and E8 the number of errors in the use of 3PL system.

The second-level indexes under F efficiency: F1 warehousing cost, F2 transportation cost, F3 circulation and processing cost, F4 energy consumption control; the weights are 0.2675, 0.484, 0.084, 0.1636 respectively. Among them, F2 transportation cost accounts for the highest weight, followed by F1 warehousing cost, followed by F4 energy consumption control.

In this research, the reliability of the study is discussed in detail.

In order to prevent the consistency deviation from being too large, it is necessary to judge whether the matrix is within the error range by consistency test. The test

methods are as follows:

1 consistency inspection index

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

2 average random consistency index RI.

3 find out the relative consistency test coefficient.

$$CR = CI/RI$$

When the judgment matrix A $CR < 0.1$ or $\lambda_{max} = n$, it shows that the comparison matrix has good consistency and is acceptable, otherwise the judgment matrix needs to be modified.

5.4 Comprehensive Evaluation Calculation Model

When BJ needs practical application and uses the comprehensive evaluation model of automobile special steel high-quality logistics service quality, two aspects need to be considered, one is the standardization of data to prepare for comprehensive evaluation, the other is the comprehensive measurement of effect, different comprehensive evaluation methods should be selected according to different assessment objectives.

5.4.1 Standardization of Data

As the nature and scope of each index is different, in order to enhance the comparability of the data, dimensionless and polarity transformation must be carried out to unify the dimension and polarity of the index value.

(1) Dimensionless Data

There are many methods to deal with dimensionless, such as initial value method, mean value method, interval value method, linear interpolation method, and mean variance method. Among them, the averaging method is relatively simple and practical, so this thesis uses the averaging method to deal with the index value dimensionless. The evaluation index can be set as Ci, and the value of n time to the evaluation index Ci can form a sequence $x_i = (X^{(1)}{}_i, X^{(2)}{}_i, \ldots X^{(k)}{}_i, \ldots, X^{(n)}{}_i)$. First, the mean E (Xi), of the sequence x_i is obtained, and then the dimensionless sequence $x_i^{'}$ is obtained by comparing the elements of the sequence with its mean. The formula is as follows:

$$X^{(s)}{}_i{}' = \frac{X^{(s)}{}_i}{E(X_i)}$$

Among them, $X^{(s)}{}_i$ is the original value of the *i-th item* index in *s-th* time, *E (Xi)* is the mean value of all the time of the *i-th* item index, and $X^{(s)}{}_i{}'$ is the index value after dimensionless processing.

(2) Polarity Transformation of Data

Because the polarity of different indexes is different, for example, the larger the value of indexes, the better, while for others, the smaller the better, so it is necessary to change the polarity of collected data, which can be divided into two types: maximum polarity transformation and minimum polarity transformation. Finally, the original data should be transformed into relative values with unified dimensions, positive polarity and comprehensive evaluation in the interval of [0,1], so as to prepare for the following comprehensive evaluation. In this thesis, we transform the polarity of the dimensionless sequence xi of the evaluation index Ci to get the dimensionless and non-polar sequence vi. The specific formula is as follows:

$$V^{(s)}{}_i = \begin{cases} \dfrac{X^{(s)}{}_i{}'}{\max\limits_k X^{(k)}{}_i{}'} & x_i\text{为极大值极性序列} \\ \dfrac{\min\limits_k X^{(k)}{}_i{}'}{X^{(s)}{}_i{}'} & x_i\text{为极小值极性序列} \end{cases}$$

In the first line, Xi is maximum polarity sequence. In the second line, Xi is minimum polarity sequence.

5.4.2 Comprehensive Evaluation Measure

The evaluation of logistics service quality of automobile special steel is a comprehensive evaluation problem of multi-objective system. The synthesis methods of systematic comprehensive evaluation generally include weighted synthesis, multiplicative synthesis, substitution synthesis, and fuzzy synthesis. These evaluation methods have their own advantages and disadvantages, and should be used separately and comprehensively in a system according to actual situation and the purpose of evaluation. For example, the linear synthesis method is suitable for the situation where each index is independent of each other, it can highlight the role of larger evaluation value and larger weight index, and emphasize the influence of main factors on the evaluation results; however, because of the linear compensation relationship among evaluation indexes of weighted synthesis, this method is not sensitive to the

change of evaluation index value. The multiplicative synthesis method is suitable for situations where evaluation indexes are interdependent and need to be sensitive to the differences and changes between index values. This method emphasizes the role of smaller evaluation value and the consistency of the level of evaluation factors. In the substitution synthesis method, the compensation effect between indexes is far more sufficient than that of additive synthesis, and it is the most sufficient. No matter what the value of other evaluation indexes is, as long as one evaluation index value reaches the highest level, the whole comprehensive evaluation value will reach the highest level. This is an evaluation synthesis method similar to the determination of the main factor. Because the multi-index comprehensive evaluation requires not only the integrity of the evaluation, but also the comprehensiveness of the evaluation, the substitution method is essentially contrary to the comprehensive evaluation, and it is not suitable to be used except for special occasions. The fuzzy synthesis method can also be used to determine the main factors, focusing main factors and weighted average. Because the linear weighted sum method is widely used, the operation is concise and the meaning is clear, so this thesis uses the linear weighted sum method, namely:

$$S_k = \sum_{i=1}^{n} V^{(s)}{}_i W_i$$

Among them, S_k is the comprehensive evaluation value of the k th time period and W_{C_i} is the weight of the i th item index. The range of parameter K is generally 5-10, but it should also be added or subtracted according to the actual situation. The value of N is the same as the range of K.

5.5 Chapter Summary

On the basis of investigation and literature research, and putting forward the pre-evaluation framework of high-quality logistics service quality of automobile special steel, this chapter uses Delphi method and Analytic Hierarchy Process, combining qualitative and quantitative analysis methods, to finally determine the automobile special steel high-quality logistics service quality evaluation index system and its weight. When Delphi method is used for expert consultation, it not only ensures the diversity of expert identity, including logistics workers, managers and

academic researchers in front-line practice, but also makes a further analysis on the enthusiasm and authority of experts combined with data analysis to ensure the reliability of data sources. In the index screening and modification, on one hand, the three boundary value criteria of index score are used to screen, including the arithmetic mean, the full score frequency and the coefficient of variation, on the other hand, the suggestions put forward by experts are fully adopted and the index is modified until the expert opinion tends to be consistent. When using the Analytic Hierarchy Process to calculate the weight, the consistency of each expert's data is checked and corrected to ensure that the index weight is scientific.

The evaluation of logistics service quality of automobile special steel is a comprehensive evaluation problem of multi-objective system. The synthesis methods of systematic comprehensive evaluation generally include weighted synthesis, multiplicative synthesis, substitution synthesis, and fuzzy synthesis. These evaluation methods have their own advantages and disadvantages, and should be used separately and comprehensively in a system according to actual situation and the purpose of evaluation. Because the linear weighted sum method is widely used, the operation is concise and the meaning is clear, so the linear weighted sum method is adopted in this thesis.

6 Improvement Strategy of Logistics Service Quality Evaluation of Automobile Special Steel Products of BJ

To establish a modern logistics system, we need to rely on high technology to track and release logistics in time, so as to realize the positioning of every link of logistics to improve the efficient operation of logistics and the rational allocation of resources, and then improve the service level of different logistics products. The high-quality logistics service system of automobile special steel is a logistics service system which takes the customer logistics demand as the starting point, and different logistics organizations go through the service process of mutual supply and demand.

6.1 Evaluation Improvement Principles and Objectives

6.1.1 Evaluation Improvement Principle

Logistics service has rapidly penetrated into social life in a short period of time, providing customers with convenient, fast, economic and safe services. In view of the wide demand for logistics services, the logistics industry has developed rapidly. This is followed by fierce competition in the logistics industry. To improve the quality of logistics service and ensure the efficiency, rapidness, accuracy, safety and economy of logistics service is a reliable way to improve the competitiveness of logistics enterprises.

The improvement of logistics service quality is the key to survival and development of logistics enterprises and an important link to improve the market competitiveness of logistics enterprises. Combining practice and changing ideas is an effective strategy to improve logistics service quality. At the same time, we should pay attention to the cultivation of service consciousness and cooperation consciousness of logistics enterprises, so that they can be customer-oriented, think for others, and do a good job in logistics service, so as to promote the continuous improvement of logistics service quality and promote the development of enterprises.

(1) Change the concept to ensure the improvement of logistics service quality

Logistics service is a comprehensive and integrated process. In view of the current situation of logistics service, changing concepts and innovating logistics service forms are still the key to improve the quality of logistics service.

First, we should correctly understand the integrity of logistics service, study the relationship between various links and systems of logistics service, find out its inherent law, and construct the concept of logistics service management as a whole to constantly improve the quality of logistics service in theory and practice.

Second, improve logistics enterprises and logistics enterprise employees' understanding of logistics service, grasp customer needs to improve service content, optimize service process, and improve service quality. On one hand, we should fully understand various links and working contents of the operation of logistics enterprises, and improve working methods and service quality pertinently; on the other hand, we should clarify customer needs and flexibly use the concept of logistics to provide customers with more humane logistics services and improve customer satisfaction. For example, in view of characteristics of large variety and small quantity of current logistics, personalized services are introduced to meet customer needs with multi-frequency and less quantitative logistics services.

Third, understand the unity and resource sharing of logistics service management system in a dialectical way of thinking, only by strengthening cooperation can we effectively enhance the integration of logistics and provide customers with more intimate and high-quality services. For example, through negotiation and cooperation with other logistics enterprises, an alliance with complementary advantages is formed, from placing orders to delivering goods to customers to implement all-round and considerate service, which not only reduces the cost of logistics services, but also facilitates customers. It can be said to have achieved a win-win situation by improving the quality of logistics service and winning better logistics management efficiency and customer satisfaction.

Fourth, do a good job in the study and publicity of logistics service work, constantly improve the level of awareness of service among logistics service participants, strengthen employees' awareness of service quality, and be able to take the initiative to make progress while working in strict accordance with working standards. Constantly improve their professional level and business operation skills, maintain a healthy and noble professional ethics, and attach importance to the improvement of the service spirit and service quality of all personnel, so as to promote the improvement of logistics service quality.

(2) Customer-oriented, promote the improvement of logistics service quality

In any service industry, customers are the key to the survival and development of

enterprises. The logistics service industry should pay special attention to the development and maintenance of customers, so that its service can be affirmed and its service quality can be continuously improved.

First, accurately understand the connotation of logistics, do a good job in every detail of logistics process in the spirit of customer service, integrate logistics services, provide customers with characteristic logistics service chain, and deliver goods to customers safely, accurately and quickly. In the process of service, on one hand, we should reflect the enthusiasm and technology of service, improve the quality of service; on the other hand, we should embody the service spirit of people-oriented, so that we can think more and better for customers and do our own work well at the same time, and pay attention to the extension of services.

Second, logistics service is a comprehensive service industry with certain complexity and professionality. In the operation of logistics enterprises, it is necessary to have a strong sense of competition and comparative learning in the same industry. It is also necessary to learn from other service industries in order to promote customer satisfaction and constantly enrich the connotation of logistics services. In addition, we can also learn from foreign advanced service concepts, service technology, combined with the practice of logistics services in China, and constantly improve the quality and level of logistics services in China.

Third, the customer-oriented service spirit requires that service-related personnel must change their ideas to provide customers with standardized and advanced services. On one hand, it is necessary to understand the selectivity and comparability of customers for logistics services, and it is not what kind of services logistics enterprises provide, what kind of services customers need to accept, so enterprises' services should be positive and they are able to constantly improve in the process of service practice under the guidance of logistics service theory, combined with the actual work experience of logistics service. Summarize and reflect frequently to continuously improve the quality of logistics service.

Fourth, refine the content of work, constantly improve the quality of service, and meet the different needs of different types of customers. On one hand, we should attach importance to the formulation and effective implementation of logistics service quality standards, combine logistics practice to deliver goods to customers at appropriate prices and appropriate modes of transportation in a short period of time, so as to ensure the realization of the usable value of goods and improve customer

satisfaction. On the other hand, strengthen the construction of logistics service technology standardization, in order to promote the speed of logistics, bring more satisfactory service for customers, at the same time reduce errors, improve efficiency, promote the development of enterprises, and improve the quality of logistics services.

Fifth, pay attention to the professionalism and advance of logistics services, actively adopt advanced logistics technology to improve logistics service system, and realize the intelligence of logistics services and improve the quality of logistics services through the interconnection of people, computers and networks. On one hand, we should adhere to the principle of service, carry forward the spirit of service, persist in doing better in the process of logistics service, and do things that are conducive to improving the quality of service. Even if the customer does not know the logistics-related service personnel, customers should patiently explain what they do not understand to ensure that the service is thoughtful and comprehensive. On the other hand, in the process of logistics service, the unexpected logistics service personnel should remember the initiative of service, have the spirit of advanced service, and try their best to achieve the best service.

(3) Attach importance to the improvement of quality of talents and constantly improve the quality of logistics service

In the era of market economy, especially in the era of world economic integration, talents are not only the core force for the development of enterprises, but also the key force to improve the competitiveness of enterprises and promote the development of enterprises. In logistics enterprises, personnel have the characteristics of complexity and diversification, and the improvement of personnel quality and the cultivation of cooperation ability is one of the important conditions to promote the continuous improvement of logistics service quality. On one hand, logistics enterprises should attach importance to the reservation of talents, absorb and train talents in various aspects to promote the development of logistics industry; on the other hand, they should pay attention to the improvement of quality of talents and improve their comprehensive ability by means of training and ideological education, so that they can have a better development and breakthrough in the logistics service industry, be able to love their own career and make suggestions for doing a good job.

First, improve the awareness and ability of collaboration among personnel, promote the connection of various links in logistics services, improve logistics speed and logistics efficiency, and ensure the level of service.

Second, the improvement of personnel quality is conducive to the communication between personnel and customers, the maintenance of old customers and the development of new customers. At the same time, they can give full play to enthusiasm and initiative in their work, good at finding problems in their work and actively look for solutions, effectively promote the improvement of work quality and improve the overall level of logistics service.

In terms of personnel quality training, first, attach importance to the development of logistics enterprise culture and influence the thought and behavior of enterprise employees through logistics service culture, make them gain a sense of belonging and pride, at the same time improve employees' sense of service, enhance their service spirit, and make them more actively involved in logistics services. Second, set an example for employees, give strong recognition and publicity to employees who have good performance in logistics services, enhance corporate image, call on more employees to actively learn, and constantly improve the quality of logistics services; third, through both material and psychological incentives to promote employees to take the initiative to pay attention to their own quality improvement, continuous progress in ordinary positions, and contribute to the improvement of logistics service quality.

(4) Optimize logistics service combined with practice in order to promote the continuous improvement of logistics service quality.

The improvement of logistics service quality is a dynamic and continuous process. Only through continuous exploration and reflection in practice can we effectively reform and optimize problems and ensure the continuous improvement of logistics service quality.

First, in view of problems in the process of logistics service, put forward effective solutions to promote the improvement of logistics service quality. For example, if we give too much commitment to customers in logistics services, the results cannot be implemented, resulting in a decrease in customer satisfaction. Therefore, we should accurately grasp customer needs, standardize the standards of logistics services, form unified, comprehensive and integrated logistics services, and feedback logistics information to customers in a timely manner to improve the quality of logistics services.

Second, in view of the development trend of the service industry, boldly innovate logistics services to provide customers with more convenient, faster and safer logistics

services.

Third, combined with the development of science and technology, its advanced technology is scientifically and reasonably applied to the logistics service process to promote the improvement of logistics service quality.

Fourth, combined with the development trend of logistics services, actively expand the content of logistics services, refine the logistics division of labor, and refine the logistics work, to ensure the sustainable development of logistics services and promote the improvement of logistics service quality.

6.1.2 Evaluation Improvement Objectives

BJ insists on more than ten years' experience of high-quality logistics service quality, and on this basis, the content of high-quality logistics service roughly covers: integrity, safety, greenness, collaboration, efficiency, quality and other service contents. BJ believes that as the connotation of high-quality logistics, it runs through the corporate culture and daily business activities.

(1) Improve the quality of logistics service

The form of logistics will change with the difference of logistics service quality. Therefore, logistics service quality is the prerequisite for the construction of logistics system. How to plan the logistics network, how to set up logistics facilities and how to formulate logistics strategy must be based on a certain logistics service quality. Talking about logistics without a certain logistics service quality is water without a source, a tree without roots.

(2) Ensure the safety of iron and steel logistics

The logistics process includes seven main work links, such as transportation, loading and unloading, handling, stacking, storage, packaging and logistics processing, and the safe operation should run through and cover the whole process of logistics. Problems in any link will lead to varying degrees of property losses or casualties. Therefore, the safety of iron and steel logistics is very important.

(3) Integrity management, reputation basis

Integrity is the criterion for us to be a man, to do things, and to behave. As an enterprise, it is even more so. When dealing with customer grievances and major accidents, we must take honesty as the first criterion. Integrity management, do not commit illegal crime, do not do anything to deceive consumers, this is the first magic

weapon for us to run and grow the enterprise. While maintaining integrity at the same time, we need to establish the brand of our enterprise. Brand establishment is more complex, but is also the best way to test whether the enterprise is honest or not.

(4) Operate efficiently and reduce costs

Logistics cost is the sum of activated labor and materialized labor consumed in logistics activities. That is, the sum of all costs associated with logistics activities. Logistics cost is also called logistics expense, which can reflect the economic status of logistics enterprise activities.

The essential requirement of logistics management is to seek practical results, that is, to achieve the best service and achieve the best economic benefits with minimum consumption. Active and effective logistics management is the key to reduce logistics costs and improve logistics economic benefits. To do a good job in logistics management, reasonable transportation can be realized, so that intermediate loading and unloading, storage costs and losses can be reduced, which can coordinate the relationship between logistics departments, links and workers, so as to improve the economic interests of logistics activities.

The reduction of logistics cost cannot only reflect the effectiveness of logistics management, but also directly affect the position of enterprises in the competition. By reducing the logistics cost, we can attract more price-sensitive customers. Therefore, in the process of logistics management, focus on reducing the logistics cost by planning, organizing, directing, coordinating, controlling and supervising logistics activities to achieve the best coordination and cooperation of logistics activities and to achieve the goal of reducing logistics costs and improving logistics efficiency and economic benefits.

(5) Greenness and collaboration, Innovation and Development

Green logistics refers to the process of logistics to curb the harm to the environment, at the same time, to achieve the purification of logistics environment, so that logistics resources can be fully utilized. It includes the logistics operation link and the greening of the whole process of logistics management. From the perspective of logistics operation, including green transportation, green packaging, and green circulation processing. From the perspective of logistics management process, mainly from the goal of environmental protection and resource conservation to improve the logistics system, we should consider not only the greening of forward logistics links, but also the greening of reverse logistics system in the supply chain. The ultimate goal

of green logistics is sustainable development, and the criterion to achieve this goal is the unity of economic interests, social interests and environmental interests.

The coordination of logistics has the cost advantage of network economy, which is the further development of supply chain management. It extends the scope of enterprise control to all node enterprises in the supply chain, making it possible for enterprises to obtain complete information in the supply chain in time for the first time, and the most important thing is that it lets enterprises know the status of products, such as production, transportation and whether to arrive on time.

The coordination of logistics reflects the trend of tapping new sources of logistics profits by changing logistics methods and logistics pathways. It optimizes the flow of logistics, information flow and capital flow through integrated supply chain operation from suppliers to customers, and pursues comprehensive and systematic comprehensive results.

6.2 Evaluation Improvement Measures

The improvement measures of evaluation are analyzed from four aspects: improving the logistics evaluation system, straightening out the performance appraisal process, defining the index assessment object and strengthening the incentive and restraint mechanism.

6.2.1 Improve the Logistics Evaluation System

High-quality logistics should take the better improvement of the guarantee ability and service level of production and marketing as the starting point, reduce the logistics cost and improve the overall efficiency as the foothold, integrate the internal logistics resources intensively, and implement integrated and professional management and make steady progress to achieve the rationalization and effectiveness of logistics management.

The evaluation index system should give comprehensive consideration to theory and practice, so the designed evaluation system should be true and reliable when reflecting the service quality of BJ. When designing the evaluation index system, we should consider not only the relationship between external conditions and the index system, but also the relationship among indexes in the index system, and construct the evaluation index system from a systematic point of view. In order to make the evaluation results more objective, both quality and quantity are indispensable, so

qualitative and quantitative analysis should be combined. The selected indexes should cover all aspects that affect the service quality of the enterprise. Thus, BJ can effectively achieve standardized and systematic management, improve the management level through bench-marking, help customers establish an objective and systematic evaluation basis for logistics service enterprises and their services, and establish a bridge of trust between enterprises and logistics service organizations.

6.2.2 Straighten out the Performance Appraisal Process

On the basis of the internal and external investigation of BJ, we should take stock of each business link of BJ and analyze the business process.

(1) build an information management platform to realize data integration and sharing: logistics business operation is driven from top-down management and control to bottom-up information integration, build logistics management and control platform and logistics information portal, and integrate logistics-related support systems, realize the global information sharing of logistics business.

(2) promote the coordination of logistics business and realize the effective management and control of logistics: strengthen the business coordination and information coordination among logistics departments through the system, realize the integration of management and information system, and strengthen the overall management and control of logistics business.

(3) construct the logistics management and control system to realize the whole logistics management: through the construction of the company-level logistics management and control system, realize the unified, integrated, point and area coordinated management of logistics business, and achieve the integrated logistics management of BJ.

(4) multi-dimensional analysis of logistics information to provide support for logistics decision-makers: multi-dimensional data analysis of integrated logistics data, analysis of logistics process, and decision support for logistics decision-makers.

The realization of the whole process of logistics management is a long-term systematic project, which needs to be continuously improved and perfected in the process of building the logistics management information platform and its application in the future. Therefore, pay attention to business carding and the improvement of management and control mechanism, and then continue to improve the strategic level after tamping the foundation of the whole logistics management level.

6.2.3 Make Clear the Target of Index Assessment

The performance appraisal index is the basic element of performance appraisal, the establishment of effective performance appraisal index is the guarantee of the success of performance appraisal, and the performance appraisal index becomes the central link of establishing the performance appraisal system. At the same time, it has also become the most concerned issue for enterprise managers.

The main contents are as follows: (1) On the basis of the previous analysis of the process, further job analysis is based on the assessment objectives. The job content of the assessment object and the conditions for completing these jobs are studied and analyzed, and the elements of performance appraisal are preliminarily determined.

(2) Analyze the workflow. Performance appraisal indexes must be grasped from the process, and if there are problems in the process, the process needs to be optimized or reorganized.

(3) Analyze the performance characteristics. Find out the performance characteristics of each index element, and select it according to different weights according to the principle of few but fine.

(4) Theoretical verification. The designed performance appraisal elements are verified according to the basic principles of assessment to ensure that they can effectively reflect performance characteristics and assessment objectives of assessed objects.

(5) Carry on factor investigation and determine the index. After the initial determination of assessment elements, a variety of ways are used to conduct a survey, and finally the performance evaluation index system is determined.

(6) Revise to determine that good performance indexes are more reasonable.

6.2.4 Strengthen the Incentive and Restraint Mechanism

In order to comprehensively strengthen the service consciousness and behavior standardization of all BJ staff, and improve the enthusiasm and subjective initiative of the work, so as to ensure the service quality, improve the efficiency, enhance the image of BJ, and strengthen the market competitiveness of BJ in the logistics industry. Therefore, the evaluation index system should be used to assess the whole staff. The aim is to improve the daily work behavior of employees and give full play to their enthusiasm and subjective initiative in order to achieve BJ organizational goals.

(1) Management function: the content of assessment, that is, where BJ currently

requires employees to do or improve, the monthly overall assessment results can reflect the overall management performance of that month.

(2) Incentive function: the purpose of implementing performance appraisal is to reward the good and punish the bad, improve and adjust the employees' behavior, stimulate their enthusiasm, and urge employees to accomplish goals more actively and normatively.

(3) Learning function: performance appraisal is also a learning process, which enables employees to better understand BJ's goals, improve their behavior, and constantly improve the overall efficiency and strength of BJ.

(4) Monitoring function: the performance appraisal of employees, for the company, is the completion of tasks in terms of quantity, quality and efficiency, and for employees, it is a comprehensive evaluation of the working status of employees for a month.

6.3 Implementation Steps

6.3.1 Project Start

A good start is half success. The early stage requires a great deal of and meticulous preparation of the project's construction background, project scope, project team members' responsibilities, project planning and objectives, and system initialization. Let the project stakeholders understand the overall situation of the project, their respective responsibilities and obligations, and let the project stakeholders make a commitment to the support and cooperation needed in the process of project construction, so that all parties can reach a consensus on issues related to the construction of the project.

6.3.2 Research Stage

Organize the current business according to assessment needs. Then implement staff research customized content, according to the project classification of different research methods, issue different research documents.

6.3.3 Establish an Evaluation System

On the basis of investigation, referring to the relevant literature, the evaluation index system is established according to expert opinion, and the index weight and synthesis method are determined.

6.3.4 Carry Out Evaluation

Through the project team to carry on the preliminary confirmation to the evaluation system, and then carry out the preliminary test. Work together to develop training programs, prepare and issue training notices, make preparations before training, and then evaluate it.

6.3.5 Performance Comparison

Compare the enterprise performance before and after the evaluation, and find the value of the evaluation index and existing problems.

6.4 Safeguard Measures

6.4.1 Pay attention to the construction of enterprise culture

The integration of internal logistics functions of enterprises uses IT technology to drive the integration of processes, and gradually realizes the integration and reorganization of functions and organizations. In the reorganization of institutions, special attention should be paid to the integration of corporate culture. Promote the unity of corporate culture by cultivating the concept of common values and shaping the spirit of enterprise. Cultural integration is essentially a process of re-establishing a common psychological contract, a process of unifying ideological understanding, building an emotional foundation, and building a new team, and the core is to form new and unified values of enterprise so that the mission, vision and ideas of the enterprise will be accepted, recognized and implemented by employees of the enterprise, and become the driving force and ideological guarantee for the normal operation and healthy and rapid development of the new enterprise as soon as possible.

6.4.2 Establish Integrity Evaluation System

Strengthen the coordination and communication management between BJ, suppliers and customers to achieve integrated logistics operation, and coordination and communication is based on the full trust between cooperative units, so it is necessary to build integrity mechanism, formulate logistics integrity standards, establish integrity evaluation organization and credit grade evaluation system, carry out the integrity record and evaluation of logistics enterprises, and formulate corresponding implementation methods and management regulations.

6.4.3 Pay Attention to Improvement of Personnel Quality

In the aspect of logistics IT application, the key to the construction of logistics IT

application in BJ is to train logistics talents. From academic education to short-term training, train a group of employees who are familiar with the logistics business and master certain information capabilities, so that the information work can adapt to the logistics reality of the enterprise. The establishment of a learning organization is also one of the means to train talents and improve the overall quality of employees. The so-called learning organization refers to an organic, highly flexible, flat, humanized and sustainable organization established by cultivating the learning atmosphere that pervades the whole organization and giving full play to the creative thinking ability of employees. To sum up, the learning organization has the following characteristics:

First, the members of the organization share a common vision. A common vision is the coordinate of individual, team and enterprise learning and action. For a common goal, we will have the motivation to overcome difficulties, study hard and pursue excellence. When establishing the vision, fully consider the integration of the enterprise, the team and the individual, so as to form a common vision of common concern and yearning of all members of the organization. Second, be good at continuous learning. This is the essential characteristic of learning organization, which has four meanings, namely, lifelong learning, whole-member learning, whole-process learning and group learning. Third, independent management. According to the theory of learning organization, self-management is a way to enable organization members to study while working and to combine work and learning closely. The establishment of a learning organization is the basis and guarantee of enterprise development, the need of sustainable development of enterprises, and the need to adapt to the trend of lifelong learning.

In addition, the development of distribution, processing and VMI business requires greater warehousing capacity, make full use of idle waste land to build warehousing facilities, carry out processing and distribution and other value-added services. Rely on information technology, master inventory on the way, and correctly forecast inventory. Strengthen the information sharing with suppliers, customers and logistics cooperation units, and promote the information construction level of partners with their own information construction.

6.5 Chapter Summary

The analysis of effect after the application of evaluation system by BJ is shown

in Table 6.1.

Table 6.1 Analysis of the Results of Improvements made by BJ

	Problems to be solved	Application result	Theories and methods adopted
1	The present situation of BJ's logistics service evaluation system, in what aspects is there a discrepancy between this system and BJ's high-quality logistics development strategy?	● The evaluation indexes are scattered and cannot stimulate the enthusiasm of employees. ● Because of the lack of green and sustainable development indexes, it is difficult to manage them carefully. ● The current indexes are not effective enough, so it is difficult for the evaluation system to be effective.	In order to make the evaluation results more objective, both quality and quantity are indispensable, so qualitative analysis and quantitative analysis should be combined. Comprehensive use of SCOR model, logistics industry green evaluation, balanced scorecard and other theoretical ideas to build a general framework of evaluation indexes.
2	How to select the logistics service evaluation index scientifically and effectively, so as to better meet the strategic development requirements of high-quality logistics?	● Specific indexes are listed in questionnaires and in-depth interviews. ● Experts carry out screening. ● Weight assignment by AHP method	The expert opinion method and AHP method are used.
3	How to implement the new logistics evaluation system to improve the logistics service level of BJ?	● Improve the logistics evaluation system. ● Straighten out the performance appraisal process. ● Make clear the target of index assessment. ● Strengthen the incentive and restraint mechanism	Comprehensive use of total quality management, lean management, service quality theory.

7 Index Application: Effect Analysis of Service Quality Evaluation Index of High-quality Logistics in BJ

This part first compares and analyzes the key performance before the application and implementation of the evaluation index of high-quality logistics, analyzes the key performance after the application of evaluation index of high-quality logistics, and finally evaluates and modifies the evaluation index of high-quality logistics. The content of this chapter is the application and test of the research results in practice in Chapter 5, BJ Automotive Special Steel Quality Logistics Service Quality Evaluation Index Design, and revise the above evaluation indexes to a certain extent according to the comparison results.

7.1 Comparison of Key Performance in the Application of Evaluation Indexes of High-quality Logistics

(1) Timely return rate

Before the application of evaluation index of high-quality logistics, the just-in-time rate of return order was 86.5%. After the application of the evaluation index of high-quality logistics, the just-in-time rate of return order is 89.5%. Because the revised evaluation index is more focused on process management, there was only a simple evaluation index-return order just-in-time rate. However, the improved index system comprehensively measures the logistics quality from six aspects: integrity, quality, safety, green, coordination and high efficiency, thus evaluating the whole process of high-quality logistics from all aspects of detail, so as to achieve delicacy management. The final effect is that the key index of just-in-time rate of return orders has been greatly improved.

(2) User complaint rate

Before the application of the evaluation index of high-quality logistics, the user complaint rate was 10.50%. After the application of the evaluation index of high-quality logistics, the user complaint rate is 9.7%. With the in-depth study of customer satisfaction by scholars since 1985, scholars have found that consumers'

understanding of quality is different from that of enterprises. Service quality is divided into objective quality and perceived quality. Objective quality is production-oriented, perceived quality is customer-oriented. There are obvious differences between the two, for objective quality is good service, while perceived quality is not necessarily good. Perceived quality is the service quality felt by consumers, which is influenced by consumers' background and preference and affects consumers' decision-making behavior in fact. In this context, customer-oriented satisfaction survey began to popularize, because consumers' perceived quality evaluation is regarded as the evaluation standard of service quality, so the satisfaction survey at this time is also known as perceived quality survey. Unlike the service implementation survey, which is the service process, the perceived quality survey does not ask the customer to confirm what the staff have done, but directly asks the service feeling or satisfaction, focusing on the customer's perceived service quality and the final service effect.

Perceived quality satisfaction is the evaluation of service effect, so the front-end departments can only be evaluated different from the service implementation survey, and the back-end departments that do not have direct contact with customers can also be evaluated, forming a complete front-end service evaluation system. According to service process, links and contacts that customers contact with enterprises and institutions, the perceived quality satisfaction index system is divided into one, two and three levels of indexes according to the logical inclusion relationship, corresponding and related to the relevant responsible departments one by one.

And the user complaint rate is also the embodiment of perceived quality satisfaction in reality. Because the evaluation index system of high-quality logistics covers all aspects of logistics management, it is expected that it can reduce the complaint rate of customers.

(3) Transportation cost

After the application of evaluation index of high-quality logistics, the transportation cost per ton has also been greatly reduced. Although enterprises have been emphasizing reducing costs and improving efficiency, they have not made practical use of the performance evaluation system to implement it in every link. However, by constructing a complete logistics quality evaluation index system, this concept of cost reduction runs through every link of logistics quality control, which makes each link of logistics have rules to follow and standards to follow. Therefore,

the key index of transportation cost has also been reduced.

(4) Greening and recycling

Through the application of comprehensive indexes of high-quality logistics evaluation, BJ has promoted the development of green supply chain high-quality logistics business of low-carbon environmental protection, energy saving and cost reduction in many aspects, such as purchasing, packaging, warehousing, transportation and recycling of automobile plate products.

First, green procurement: according to the monthly automobile production plan, BJ acts as an agent for the automobile factory to issue procurement demand contracts to steel suppliers. When the automobile plate production is completed, BJ gives full play to the overall effect of logistics supply chain, implements the processing and distribution JIT supply mode, and distributes the automobile plate to the automobile production workshop on time, eliminating the pressure of high inventory in the automobile factory.

Second, BJ promotes the reverse logistics business between the steel mill and the automobile plant, collecting the scrap left by stamping in the automobile plant workshop (D1 defective product and falling material recovery), processing it into a standard waste bundle, transporting it to the steel plant through the reverse logistics of the supply chain, and putting it into the blast furnace recycling, forming a natural green circulation logistics system (D3 steel plant-automobile plant-steel plant closed loop return rate). Generally, it refers to the logistics and distribution process in which the waste of automobile manufacturing enterprises is collected, reinforced and loaded according to standards, and then transported back to the iron and steel manufacturing enterprises to make new automobile plates and then sold to automobile manufacturers. The characteristics of reverse are as follows: the automobile factory, the logistics company and the iron and steel factory are in good faith and cooperate with each other, and the steel plant adopts the reverse settlement method for the freight and scrap recovery of logistics company; the transportation of logistics companies adopts the green closed loading mode of environmental protection. Steel-making enterprises adopt the economic way of recycling scrap resources, which makes the whole process of reverse logistics supply chain reflect the characteristics of integrity, safety, green, coordination, high efficiency and economy.

Third, in order to control the quality of high-quality logistics and prevent the occurrence of quality problems (B2 transport quality loss rate) in the hoisting and

transportation of automobile plates, BJ, together with Shanghai Tongji University of Science and Technology, has successfully developed a new type of automobile steel coil transportation protection system through cooperation between universities and enterprises. The products have passed the quality inspection of China Railway Research Institute Group Co., Ltd and obtained the patent certificate number: ZL201821575763.9. At the same time, based on the fact that the car board is easily affected by the humid climate in the south, BJ invented a new protective measure and obtained the certificate patent number: ZL20182196902.8 (see Appendix 2 for details). It can effectively prevent the corrosion of steel coil by rain water, greatly improve customer satisfaction and reduce the damage of goods. (B2 transportation quality loss rate).

7.2 Evaluation and Revision of Indexes of High-quality Logistics

It shows that the key performance of evaluation index of high-quality logistics has been improved after systematic evaluation. The evaluation index system of high-quality logistics is effective.

However, in practical use, C5 hazard sources and risk control, C6 safety and security regulations implementation rate, E2 freight information query service, E4 supply chain cooperation rate is difficult to achieve, so it is difficult to remove. Therefore, the new Automobile Special Steel Quality Logistics Service Quality Evaluation Index System (revised version) is shown in Table 7.1.

Table 7.1 Automobile Special Steel Quality Logistics Service Quality Evaluation Index System (revised version)

Criterion Layer	**Index Layer**
A integrity	A1 Transport Operation Plan completion rate. A2 return order timely rate. A3 plan on-time completion rate. A4 warehousing service delivery error rate. A5 loading and unloading operation plan completion rate. A6 inventory guarantee rate. A7 just-in-time rate of liquidation repository
B quality	B1 warehousing damage rate. B2 transportation quality loss rate.

	B3 Unqualified rate of loading and unloading tools. B4 cargo loading and unloading quality loss rate. B5 vehicle operating specification rate. B6 vehicle terminal unexecuted plan accuracy
C safety	C1completion rate of security inspection of transportation and hoisting equipment. C2 operator qualification standard rate. C3 security personnel training completion rate. C4 Blind spot completion rate of Civil Air Defense and Technical Defense
D greenness	D1 defective products and falling objects recovery. D2 Recycling of protective materials. D3 steel plant-automobile plant-steel plant closed loop return rate. D4 Power loss (kilowatt-hour / ten thousand yuan)
E collaboration	E1 user complaint rate. E3 customer complaint resolution speed. E5 Logistics objection claim amount of ten thousand yuan. E6 process monitoring coverage. E7 Timely repair rate of GPS equipment. E8 The number of errors in the use of 3PL system.
F efficiency	F1 warehousing cost. F2 transportation cost. F3 circulation processing cost. F4 energy consumption control

In a word, on the basis of investigation and literature research, and of putting forward the pre-evaluation framework of high-quality logistics service quality of automobile special steel, this chapter uses Delphi method and Analytic Hierarchy Process, combined with qualitative and quantitative analysis methods. Finally, determine the automobile special steel quality logistics service quality evaluation index system and its weight. When the Delphi method is used for expert consultation, it not only ensures the diversity of expert identity, including logistics workers, managers and academic researchers in front-line practice, but also makes a further analysis on the enthusiasm and authority of experts combined with data analysis to ensure the reliability of data sources. In the index screening and modification, on one hand, the three boundary value criteria of the index score are used to screen, including the arithmetic mean, the full score frequency and the coefficient of variation, on the

other hand, the suggestions put forward by the experts are fully adopted. Modify the index until the expert opinion tends to be consistent. When using the Analytic Hierarchy Process to calculate the weight, the consistency of each expert's data is checked and corrected to ensure that the index weight is scientific.

In this part, this study examines the comparison of key indexes before and after the application of the evaluation index of high-quality logistics, and finds that the company's key performance indexes have been significantly improved after the application of the evaluation index. The reason is that the assessment indexes of the original company are relatively simple and fragmented:

The following aspects are involved:

First, warehousing evaluation indexes: warehousing damage rate, warehousing service delivery error rate, timely delivery rate of goods, warehousing operation plan completion rate.

Second, transport evaluation indexes: transport quality damage rate, transport equipment failure rate, timely delivery rate, capacity guarantee rate, timely return rate, transport operation plan completion rate.

Third, loading and unloading evaluation indexes: unqualified rate of loading and unloading tools, cargo loading and unloading quality damage rate, loading and unloading operation plan completion rate.

Fourth, processing and distribution evaluation indexes: processing finished product rate, processing plan completion rate, processing packaging damage rate, timely delivery rate; customer satisfaction index.

But it is not systematic enough, and it does not measure and assess the logistics quality from the perspective of whole process and systematization. This study is the systematization, process and comprehensiveness of the original index system, so it can better control the whole process of logistics service, thus bringing about the improvement of enterprise logistics performance!

In addition, C5 hazard sources and risk control, C6 safety and security regulations enforcement rate, E2 freight information inquiry service, E4 supply chain cooperation rate through the feedback of the entire management team, found that it is difficult to assess and implement in reality. In view of the four aspects, enterprises can develop qualitative rules and regulations to implement and improve these four aspects, so as to make up for the shortcomings of the evaluation index system.

7.3 Chapter Summary

On the basis of comparing the key performance before and after, this chapter considers the suggestions of front-line managers, and modifies the evaluation index system. It is found that after the application of the evaluation index of high-quality logistics, the key performance indexes of enterprises have been significantly improved, C5 hazard sources and risk control, C6 safety and security regulations enforcement rate, E2 freight information inquiry service, E4 supply chain cooperation rate through the feedback of the whole management team, found that it is difficult to assess and implement in reality. Therefore, it is suggested that while applying the evaluation index of high-quality logistics, quantitative measures should be taken to make up for shortcomings.

8 Conclusions and Prospects

As a practitioner of high-quality steel logistics in China, BJ provides overall solutions for automotive steel processing and distribution. With the goal of becoming the highest-quality logistics service provider and the highest-quality logistics value creator, BJ is committed to providing customers at home and abroad with overall solutions for high-quality logistics, shipping agents, multimodal transport, freight forwarders, warehousing, railways, roads and supply chains. BJ has formed a fully functional network advantage, on the basis of market segmentation, focuses on the development of automotive steel plate high-quality logistics, to provide customers with overall logistics solutions of high value-added services. However, there are still problems, such as the shortage of logistics professionals, the degree of adhesion with customers needs to be improved, the supply chain process needs to be further optimized, and energy saving and environmental protection is insufficient. All these are related to the quality of logistics service, which need to be assessed by enterprises in their daily operation. The construction of a set of quality evaluation system of high-quality logistics from the six aspects of integrity, quality, safety, green, coordination and high efficiency is not only helpful to the assessment of all levels of high-quality logistics, but also to provide guidance and scientific quantitative basis for the formulation of follow-up management measures. and it is convenient for enterprises to verify and compare the effects of follow-up management measures. The establishment of this quality evaluation system cannot only lay the foundation for the development and improvement of high-quality logistics, but also promote the transformation and upgrading of enterprises in the same industry and improve the service level of China's third-party logistics industry.

In this research, the reliability and validity are discussed in detail.

1 Positive coefficient of experts.

If the recovery rate of the expert consultation form is 50% or more, the data can be used for analysis and reporting. Among them, 60% of the recovery rate is good, and 70% is very good. The recovery rates of this study are 87.5% and 100% respectively, which meet the sample recovery index required by Delphi method.

2 The degree of authority of experts.

According to statistical experience, the degree of expert authority Cr≥0.7 is acceptable. From the coefficient of the first-level index, we can see that the degree of

authority of each item is more than 0.7, and the average value is 0.84. According to the functional relationship between the degree of expert authority and this accuracy, the prediction accuracy of this research is high, the data can be used for analysis, and the results are credible.

(3) The coordination coefficient of experts.

The coordination coefficient of expert opinions reflects the consistency of different experts' opinions on the importance of each index, and it is also an important indicator that consultation results are reliable. The coordination coefficient W is between 0 and 1, and the larger the W is, the better the coordination degree is. The general coordination coefficient fluctuates in the range of 0.5.

The coordination coefficients of the two rounds of consultation in this research are 0.379 and 0.490 respectively, indicating that the coordination of experts is getting higher with the increase of rounds. Among them, the test value of coordination coefficient P is 0.000, which reflects that experts' understanding of the importance of evaluation indicators at all levels tends to be consistent, and the results are desirable and reliable.

In the part of AHP analysis, the issue of reliability is fully considered:

In order to prevent the consistency deviation from being too large, it is necessary to judge whether the matrix is within the error range by consistency test. The test methods are as follows:

1 Consistency inspection index

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

2 Average random consistency index RI.

3 Find out the relative consistency test coefficient.

$$CR = CI/RI$$

When the judgment matrix A $CR < 0.1$ or $\lambda_{max} = n$, it shows that the comparison matrix has good consistency and is acceptable, otherwise the judgment matrix needs to be modified.

8.1 Conclusions and Revelations

At present, automobile special steel logistics belongs to a branch of iron and steel logistics, which is characterized by high efficiency, high quality and green

environmental protection. First, high efficiency. Take the needs of users as one of the most important aspects: for example, some users order ordinary goods, then improve the logistics speed; some users want to follow the production beat, then need to deliver goods according to the needs of manufacturers. Second, high logistics quality. That is, users want to ensure the quality of the product (steel coil) and avoid the apperance of outer packaging damage, collision, and scratches. Third, green environmental protection. For protective and gasket materials, on one hand, to ensure product quality and save costs; on the other hand, to realize green environmental protection.

The purpose of this research is to answer three research questions:

(1) The present situation of BJ's logistics service evaluation system, in what aspects is there a discrepancy between this system and BJ's high-quality logistics development strategy?

However, at present, BJ's existing logistics service evaluation system has not been designed and improved according to high-quality logistics standards. It is embodied in the following aspects.

First, evaluation indexes are scattered and cannot stimulate the enthusiasm of employees. The indexes are not systematic, the indexes are not related and scientific, cannot stimulate the enthusiasm of employees, and the evaluation characteristics of high-quality logistics are not reflected.

Second, becaue of the lack of green and sustainable development indexes, it is difficult to perform delicacy management. Although BJ attaches great importance to green and sustainable development, and has made useful explorations in practice, it still lacks a complete evaluation index system of green supply chain, which cannot really promote sustainable operation, lack of contribution to society and environmental protection, and the assessment of various departments and employees only stays in the stage of qualitative concept publicity and implementation.

Third, the effectiveness of current indexes is insufficient, and the evaluation system is difficult to be effective. At present, the implementation of BJ's logistics service quality is to strictly ensure the authenticity of assessment indexes through the incentive mechanism for the human resources department and the finance department. At present, an objective and fair automatic assessment system of non-human intervention has not been established in terms of system and information system. Although the current security means of BJ are effective, for example, wearing a

helmet when entering a dangerous place and refusing open fire in a dangerous warehouse, it is mainly because the high-pressure policy of the management department is effective; employees have not formed voluntary behavior, and the concept of total quality management and service management has not been internalized into the corporate culture. Therefore, the safeguard is too tough, which increases conflict between employees and management, and the indexes will vary. Therefore, there is an urgent need to propose a complete set of logistics service quality assurance measures which is people-centered, not only to consider the use of rigid constraints of the system, but also to consider the use of soft constraints of cultural construction to create a good atmosphere of total quality management.

(2) How to select the logistics service evaluation index scientifically and effectively, so as to better meet the strategic development requirements of high-quality logistics?

On the basis of practical investigation and literature research and of putting forward the pre-evaluation framework of high-quality logistics service quality of automobile special steel, this research uses Delphi method and Analytic Hierarchy Process, combined with qualitative and quantitative analysis methods. Finally, determine the automobile special steel quality logistics service quality evaluation index system and its weight. When the Delphi method is used for expert consultation, it not only ensures the diversity of expert identity, including logistics workers, managers and academic researchers in front-line practice, but also makes a further analysis on the enthusiasm and authority of experts combined with data analysis to ensure the reliability of data sources. In the index screening and modification, on one hand, the three boundary value criteria of the index score are used to screen, including the arithmetic mean, the full score frequency and the coefficient of variation, on the other hand, the suggestions put forward by the experts are fully adopted. Modify the index until the expert opinion tends to be consistent. When using the Analytic Hierarchy Process to calculate the weight, the consistency of each expert's data is checked and corrected to ensure that the index weight is scientific.

The evaluation of logistics service quality of automobile special steel is a comprehensive evaluation problem of multi-objective system. The synthesis methods of systematic comprehensive evaluation generally include weighted synthesis, multiplicative synthesis, substitution synthesis, and fuzzy synthesis. These evaluation methods have their own advantages and disadvantages, and should be used separately

and comprehensively in a system according to actual situation and the purpose of evaluation. Because the linear weighted sum method is widely used, the operation is concise and the meaning is clear, so the linear weighted sum method is adopted in this thesis.

(3) How to implement the new logistics evaluation system to improve the logistics service level of BJ?

According to the focus of evaluation system, this research first puts forward the principles and objectives of evaluation improvement, then puts forward suggestions for the optimization of high-quality logistics system, and finally points out the implementation steps and safeguard measures.

8.1.1 Management Enlightenment

Management Enlightenment 1: the construction of a set of systematic and perfect automobile special steel high-quality logistics service quality evaluation system is the basis of management decision-making.

The index system refers to an organic whole composed of relatively independent and interrelated statistical indexes that reflect the overall quantitative characteristics of social and economic phenomena. In statistical research, to have an overall picture, it is often not enough to use only one index, because it can only reflect the quantitative characteristics of a certain aspect of the whole. At this time, it is necessary to use multiple related indexes at the same time, and the unified whole composed of related and independent indexes is the index system.

With the rapid development of social economy, the arrival of the pattern of world economic globalization and the intensification of international trade, modern society is gradually entering a service-oriented new century, and the role of the service industry is becoming more and more important. China's logistics enterprises started relatively late, many enterprises are transformed from the traditional storage and transportation enterprises, with single function, weak service consciousness, and low service quality. In recent years, with the continuous development of market economy, service quality has gradually become a prerequisite for enterprises to gain competitive advantage. If enterprises want to expand market share, strive for a wider customer base, and improve the service system, enhancing service quality is a very effective strategy. At present, more and more scholars devote themselves to the research on the

service quality evaluation of logistics enterprises, and have made a lot of achievements, but most of them are guided by the quality management theory of industrial enterprises. In China, logistics service quality refers to the result of a series of activities carried out by enterprises to meet logistics needs of all customers, including internal and external customers. There has been a lot of research on the evaluation index system of service quality of logistics enterprises, and indexes can be summarized as satisfaction, service level, commodity integrity rate, delivery quality, and delivery level. The defects in the research of service quality management of logistics enterprises are as follows: the evaluation result is vague, customer satisfaction has almost become the only method to evaluate service, and there is a lack of unified evaluation criteria. In order to improve the service quality, logistics enterprises must find out the restrictive factors that affect the service quality, which requires an accurate evaluation of service quality of logistics enterprises.

In this thesis, through the investigation of the current situation of service quality evaluation of BJ, it is also found that evaluation indexes are scattered and cannot stimulate the enthusiasm of employees; the lack of green and sustainable development indexes makes it difficult to perform delicacy management; the effectiveness of the current indexes is insufficient and the evaluation system is difficult to be effective.

At present, the assessment indexes of BJ involve the following aspects:

First, warehousing evaluation indexes: warehousing damage rate, warehousing service delivery error rate, timely delivery rate of goods, warehousing operation plan completion rate.

Second, transport evaluation indexes: transport quality damage rate, transport equipment failure rate, timely delivery rate, capacity guarantee rate, timely return rate, transport operation plan completion rate.

Third, loading and unloading evaluation indexes: unqualified rate of loading and unloading tools, cargo loading and unloading quality damage rate, loading and unloading operation plan completion rate.

Fourth, processing and distribution evaluation indexes: processing finished product rate, processing plan completion rate, processing packaging damage rate, timely delivery rate; customer satisfaction index.

But it is not systematic enough, and it does not measure and assess the logistics quality from the perspective of the whole process and systematization. This study is the systematization, process and comprehensiveness of the original index system, so it

can better control the whole process of logistics service, thus bringing about the improvement of enterprise logistics performance!

As the basis of decision-making, it is necessary to grasp the current situation of logistics services and find the gap to improve the level; to build a performance incentive mechanism to quantify the development goals of enterprises; to build a logistics service platform to promote the transformation and upgrading of enterprises; and to participate in international market competition. it is very necessary to enhance corporate social responsibility.

Management Enlightenment 2: the combination of Delphi method and Analytic Hierarchy Process can well combine the practical experience of practical circles and the recent research results of academia, which helps to ensure the innovation and practicality of this assessment index.

From the perspective of quantitative evaluation methods, there are mainly Analytic Hierarchy Process (AHP), fuzzy comprehensive evaluation method, principal component analysis method, DEA method. However, the above methods need to use more complex mathematical models, which are not suitable for practice.

Delphi method has the characteristics of anonymity, multiple feedback and group statistics.

(1) It is simple and intuitive, and there is no tedious mathematical model.

(2) Experts can express their opinions independently, and they do not influence each other.

(3) The results obtained by Delphi method synthesize the collective wisdom and are more reliable and accurate.

Therefore, the Delphi method is used in this research, which cannot only combine the practical experience of the practical community and the recent research results of academic circles, but also help to ensure the innovation and practicality of this assessment index.

Analytic Hierarchy Process (referred to as AHP method), which was put forward by American operations researcher A.L.Saaty in the 1970s, is a qualitative and quantitative decision analysis method. It is a process of modeling and quantifying the decision-making thinking process of the decision-maker to the complex system. By using this method, decision makers can get the weights of different schemes by decomposing the complex problems into several levels and factors, and making a simple comparison and calculation among the factors, which provides a basis for the

selection of the best scheme.

The basic principle of AHP: the AHP method first hierarchically divides the problem into different levels according to the nature of problem and the general goal, forming a multi-level analytical structure model, which is divided into the lowest level (schemes and measures for decision-making), relative to the determination of the relative importance weights of the highest level (total objectives) or the ranking of relative advantages and disadvantages.

Characteristics of Analytic Hierarchy Process (AHP):

- The train of thought of the analysis is clear, and the thinking process of the system analyst can be systematized, mathematized and modeled.
- There is not much quantitative data needed in the analysis, but it is necessary to be specific and clear about the factors contained in the problem and their relationships.
- This method is suitable for the decision-making analysis of complex problems with multi-criteria and multi-objectives, and is widely used in the comparison of regional economic development programs, the evaluation of scientific and technological achievements, resource planning and analysis, and the quality evaluation of enterprise personnel.

The evaluation of logistics service quality of automobile special steel is essentially a comprehensive evaluation problem of multi-objective system. The synthesis methods of systematic comprehensive evaluation generally include weighted synthesis, multiplicative synthesis, substitution synthesis, fuzzy synthesis. These evaluation methods have their own advantages and disadvantages, and should be used separately and comprehensively in a system according to the actual situation and the purpose of evaluation. Because the linear weighted sum method is widely used, the operation is concise and the meaning is clear, so the linear weighted sum method is adopted in this thesis.

Management Enlightenment 3: it is found that evaluation indexes of high-quality logistics are difficult to assess, and it is suggested that safeguard measures should be taken to make up for deficiencies.

This research examines the comparison of key indexes before and after the application of the evaluation index of high-quality logistics, and finds that the key performance indexes of BJ have been significantly improved after the application of the evaluation index. The reason is that the assessment index of the original company is relatively simple and scattered:

The following aspects are involved:

First, warehousing evaluation indexes: warehousing damage rate, warehousing service delivery error rate, timely delivery rate of goods, warehousing operation plan completion rate.

Second, transport evaluation indexes: transport quality damage rate, transport equipment failure rate, timely delivery rate, capacity guarantee rate, timely return rate, transport operation plan completion rate.

Third, loading and unloading evaluation indexes: unqualified rate of loading and unloading tools, cargo loading and unloading quality damage rate, loading and unloading operation plan completion rate.

Fourth, processing and distribution evaluation indexes: processing finished product rate, processing plan completion rate, processing packaging damage rate, timely delivery rate; customer satisfaction index.

But it is not systematic enough, and it does not measure and assess the logistics quality from the perspective of the whole process and systematization. This research is the systematization, process and comprehensiveness of the original index system, so it can better control the whole process of logistics service, thus bringing about the improvement of enterprise logistics performance!

In addition, C5 hazard sources and risk control, C6 safety and security regulations enforcement rate, E2 freight information inquiry service, E4 supply chain cooperation rate through the feedback of the entire management team, found that it is difficult to assess and implement in reality. In view of these four aspects, enterprises can develop some qualitative rules and regulations to implement and improve these four aspects, so as to make up for the shortcomings of the evaluation index system.

8.1.2 Theoretical Enlightenment

Based on the theories of total quality management, lean management and service quality theory, this thesis explores the mode and operation mechanism of the integration of logistics resources in the relationship between supply and demand, evaluates the service quality of iron and steel logistics, further enriches and improves the theory of logistics quality evaluation, and enriches and improves the theoretical system of iron and steel logistics based on the relevant theories of total quality management, lean management and service quality theory.

Theoretical Enlightenment 1: from the perspective of logistics service supply chain, this research systematically constructs the evaluation system of third-party iron and steel logistics, which enriches research results in the field of iron and steel logistics.

At present, there is no clear consensus on the definition of logistics service supply chain. The view with high recognition is that in a narrow sense, the logistics service supply chain can be understood as the supply and demand cooperation structure of network chain from the upstream functional logistics enterprises to the integrated logistics service providers to end customers in order to provide integrated integrated logistics services. On the other hand, the logistics service supply chain in a broad sense can be extended to upstream providers of logistics facilities, equipment and information technology, and includes the cooperation structure composed of all enterprises or departments that cooperate with each other in order to realize the demand of integrated logistics services.

Logistics service supply chain has the following characteristics:

Logistics service supply chain is formed with the development of logistics service industry. The continuous growth of service outsourcing and product service and rapid development of related services have laid a solid foundation for the emergence and development of service supply chain. This model connects the logistics operations on the chain, such as transportation, storage, packaging, procurement, circulation, processing and distribution, with logistics end-users to form a whole functional network chain. The alliance logistics service enterprises in the chain show obvious industry characteristics in the process of collaborative cooperation and competition, information sharing, risk sharing, common decision-making, common development and mutual benefit.

(1) Complexity of the system

Logistics service supply chain system is a complex network composed of participants and multiple nodes, such as logistics service subcontractors, logistics service integrators and logistics service demanders, and it is difficult to coordinate among members. At the same time, the service supply chain, as a component of supply chain, has a certain intersection with product supply chain. Each enterprise and department of enterprise have different functions but are related to each other. Information flow, capital flow, business flow and other elements interact with each other in the same system. In addition, the logistics service supply chain system is the

product of the change of business environment, and changes of economy and politics, including the natural environment, will promote the dynamic development of the system itself, so the logistics service supply chain has a high degree of complexity and instability.

(2) Strong information processing ability

Because of the extensiveness and heterogeneity of logistics demand, when logistics service integrators design business processes and purchase, produce and sell according to the needs of consumers, design and choose the best operation plan, it is necessary to process and classify the customer's information such as transfer, warehousing and distribution, coupled with the different geographical location of the customer and the complexity of the logistics network formed by service elements. The logistics service supply chain system must have strong information processing ability and operate smoothly when members of the logistics service supply chain can share information in real time. Rapid information processing technology is the core competence of integrated logistics service providers, which highlights the typical advantages of logistics service supply chain, and is also the fundamental difference between logistics service integrators and traditional functional logistics enterprises.

(3) The guarantee of service ability

Logistics service is a kind of service product, which has five dimensions: reliability, security, responsiveness, empathy and invisibility. Among them, reliability refers to the ability to perform promised service accurately and reliably, which is one of the most important determinants of customer perceived service quality. Because the chain is a complex network structure composed of enterprises that undertake logistics functions, it is necessary to integrate intangible logistics management knowledge and tangible logistics facilities and equipment in the supply chain. to provide timely, reliable and satisfactory integrated logistics services to logistics customers, which will affect whether the whole supply chain can survive and develop in the increasingly competitive logistics service market and whether it can gain competitive advantage.

(4) Strong complementarity

Logistics service supply chain provides intangible logistics services to customers, and its service capacity is not determined by the level of a subcontractor or integrator, but by the joint action of elements and interest entities. These elements and entities are linked together through complementary relations, so as to achieve the optimization of the overall function of supply chain. Logistics service integrators with high

organizational management ability select appropriate logistics professional subcontractors at an appropriate time to encourage subcontractors to effectively achieve specific logistics service functions; while subcontractors with strong professional capabilities need integrators with higher organizational and management capabilities to integrate and coordinate and cooperate to provide satisfactory logistics services to customers. Therefore, the relationship between the integrator and the main subcontractor is a strategic complementary partnership of risk-sharing and benefit-sharing, which is highly complementary.

(5) The system is highly integrated

Logistics service supply chain is the application of integrated management ideas and methods, around a certain logistics service demand, integration of all member enterprises in the chain of personnel, processes and technology and other superior resources, and the rapid integration of logistics resources to meet customer needs. For the same service product, implement the integration of service standardization, business standardization and management to form a seamless operation whole. The services it provides include not only transportation, warehousing and distribution services, but also report management, information management, business consultation, carrier selection, freight forwarder, customs declaration, product repackaging, inventory replenishment, labeling and other functions.

At present, the research on logistics service quality is mostly based on logistics service providers, and there is a lack of research on logistics service quality from the perspective of the relationship between logistics supply and demand for a specific enterprise or industry. This thesis studies the integration of iron and steel logistics resources and service quality from the perspective of relationship between logistics supply and demand, and integrates iron and steel logistics service supply organization and iron and steel logistics demand organization into a network, that is, iron and steel logistics supply and demand network. Thus a new perspective of logistics service quality evaluation is established.

Theoretical Enlightenment 2: this research highlights the characteristics of green and low carbon, which is helpful to theoretical discussion on the sustainable development of iron and steel logistics enterprises.

The current situation of logistics development in China is developing rapidly, but it needs to be improved for a long time in terms of green environmental protection and energy saving and emission reduction. The material basis of traditional logistics

development is to consume energy to achieve the purpose of rapid development. The energy consumption of logistics industry is mainly traditional kerosene, gasoline and diesel oil, all of which are high-carbon energy consumption. Under the background of the development of low-carbon economy, the extensive development mode of logistics industry, the contradiction between resource constraints and industrial development is prominent, the low utilization efficiency of energy resources and the backward technology of energy-intensive industries pose severe challenges to ecological development. Therefore, the logistics industry urgently needs to get rid of the development model of high energy consumption and high pollution, and change to low-carbon logistics with low emission and high efficiency. There is a close relationship between low-carbon logistics and low-carbon economy, which influence each other. The proposal of low-carbon economy not only brings severe challenges to the development of China's logistics industry, but also provides great opportunities for development. On one hand, with the continuous growth of logistics demand and the increasing requirements of energy saving and emission reduction, low-carbon economy gradually forms a reverse mechanism for low-carbon logistics. It is imperative to adopt advanced scientific and technical means to develop more efficient, energy-saving and environmentally friendly low-carbon logistics. On the other hand, low-carbon logistics is an important measure to practice the operation and development of low-carbon economy. The logistics industry plays an important role in the national economy and is the main driving force for China's economic growth and social progress at the present stage. Under the background of the shortage of resources and energy and the serious threat to the ecological environment, the development of low-carbon logistics can improve energy efficiency, reduce carbon emissions and promote the realization of low-carbon economy.

The characteristics of low-carbon logistics are combined with the attributes of logistics from two aspects of environment and economic benefits.

Logistics has the following characteristics:

(1) low-carbon logistics is energy-saving and efficient.

The core of low-carbon logistics is low-carbon, which requires low energy consumption, low pollution and low emissions in the logistics process, that is, to improve the efficiency of resource utilization and reduce greenhouse gas emissions such as environmental pollution and carbon dioxide. Develop logistics in the way of energy saving and emission reduction.

(2) low-carbon logistics has multi-objectives.

The main purpose of the development of low-carbon logistics is to reduce energy consumption and carbon dioxide emissions of logistics activities through the adjustment of energy structure and the application of new technologies on the premise of ensuring the economic benefits of logistics activities, and to unify the four goals of economic, ecological, social and environmental benefits.

(3) low-carbon logistics is systematic.

Low-carbon logistics is not a simple superposition of the functional elements of logistics activities such as transportation, warehousing, loading and unloading, packaging, but a system formed under the common goal through their internal relations. The functional elements of the system are interrelated and interact with each other. Only when each functional link of the logistics system is low-carbon, can we make full use of resources and reduce carbon emissions of logistics activities.

(4) low-carbon logistics is high-tech.

Low-carbon logistics focuses on the development and application of energy efficiency technology, renewable energy technology and greenhouse gas emission reduction technology. The realization of low-carbon logistics is inseparable from advanced technology, and the application of these technologies can be either hard technology or soft technology. Hard technology includes the use of logistics equipment, such as forklift trucks, sorting machines, green transport vehicles and other equipment, while the use of soft technology refers to advanced and appropriate software operation methods, operating standards and business processes. Advanced low-carbon technology is the support and foundation for the realization of low-carbon logistics.

(5) low-carbon logistics is bi-directional.

The bi-directional nature of low-carbon logistics means that low-carbon logistics includes not only forward low-carbon logistics, but also reverse low-carbon logistics. Reverse low-carbon logistics refers to the low carbon of all kinds of derivative logistics activities arising from the rational disposal of forward logistics, including recovery, sorting, purification, purification, commercial or maintenance return, packaging and other reprocessing, recycling and waste disposal. In the early days, people's understanding of logistics was limited to forward logistics, ignoring the energy saving and emission reduction of reverse logistics and the effective use of resources. The bi-directional nature of low-carbon logistics requires that low-carbon

logistics must be realized from two aspects: forward logistics and reverse logistics.

The steel industry is not only an important basic industry of national economy, but also one of the typical industries with high energy consumption, high material consumption and high pollution. Under the new situation of vigorously promoting supply-side reform and innovation-driven strategy in China, it is necessary for iron and steel logistics enterprises to actively improve their green supply chain management organization and waste recycling level. The quality evaluation system proposed in this thesis not only embodies the four principles of traditional logistics: timeliness, accuracy, safety and economy, but also highlights the characteristics of green, ecological, systematic and innovative, taking into account economic, ecological and social benefits. It enriches the case study and practical application in the field of iron and steel logistics, which is helpful to the theoretical discussion on the sustainable development of iron and steel logistics enterprises.

Theoretical Enlightenment 3: this research, on the basis of systematic research ideas, finds problems in practice, uses relevant theories and methods to analyze problems and puts forward solutions, and finally applies this scheme to practice to solve enterprise problems. Then the theoretical scheme is verified and modified.

The research idea is to come from practice to practice, that is, to find problems in the practice of enterprise management, use relevant theories and methods to analyze the problems and put forward solutions, and finally apply this scheme to practice, so as to solve enterprise problems, and verify and modify the theoretical scheme. And not only focus on the isolated and single logistics link, but also look at the whole logistics service system from the perspective of system, and optimize the logistics service system as a whole.

For example:

Through the application of comprehensive indexes of high-quality logistics evaluation, BJ has promoted the development of green supply chain high-quality logistics business of low-carbon environmental protection, energy saving and cost reduction in many aspects, such as purchasing, packaging, warehousing, transportation and recycling of automobile plate products.

First, green procurement: according to the monthly automobile production plan, BJ acts as an agent for the automobile factory to issue procurement demand contracts to steel suppliers. When the automobile plate production is completed, BJ gives full

play to the overall effect of the logistics supply chain, implements the processing and distribution JIT supply mode, and distributes the automobile plate to the automobile production workshop on time, eliminating the pressure of high inventory in the automobile factory.

Second, BJ promotes the reverse logistics business between the steel mill and the automobile plant, collecting the scrap left by stamping in the automobile plant workshop (D1 defective product and falling material recovery), processing it into a standard waste bundle, transporting it to the steel plant through the reverse logistics of the supply chain, and putting it into the blast furnace recycling, forming a natural green circulation logistics system (D3 steel plant-automobile plant-steel plant closed loop return rate). Generally, it refers to the logistics and distribution process in which the waste of automobile manufacturing enterprises is collected, reinforced and loaded according to certain standards, and then transported back to the iron and steel manufacturing enterprises to make new automobile plates and then sold to automobile manufacturers. The characteristics of reverse are as follows: the automobile factory, the logistics company and the iron and steel factory are in good faith and cooperate with each other, and the steel plant adopts the reverse settlement method for the freight and scrap recovery of the logistics company; the transportation of logistics companies adopts the green closed loading mode of environmental protection. Steelmaking enterprises adopt the economic way of recycling scrap resources, which makes the whole process of reverse logistics supply chain reflect the characteristics of integrity, safety, green, coordination, high efficiency and economy.

Third, in order to control the quality of high-quality logistics and prevent the occurrence of quality problems (B2 transport quality loss rate) in the hoisting and transportation of automobile plates, BJ, together with Shanghai Tongji University of Science and Technology, has successfully developed a new type of automobile steel coil transportation protection system through the cooperation between universities and enterprises. The products have passed the quality inspection of China Railway Research Institute Group Co., Ltd to obtain the patent certificate number: ZL201821575763.9. At the same time, based on the fact that the car board is easily affected by the humid climate in the south, BJ invented a new protective measure and obtained the certificate patent number: ZL20182196902.8 (see Appendix 2 for details). It can effectively prevent the corrosion of steel coil by rain water, greatly improve customer satisfaction and reduce the damage of goods. (B2 transportation quality loss

rate).

8.2 Comparison with Previous Studies

The concept of performance is very extensive, which can be understood as a result, such as work efficiency, work benefit or attitude towards work, interpersonal relationship, and diligence, and a kind of behavior performance, performance, achievement. The performance evaluation of logistics service supply chain refers to the comprehensive performance of a logistics activity that is being carried out or has been completed in the logistics service supply chain. Evaluation is generally the process of determining the attribute of the object according to a clear goal and turning it into the degree to which the subjective utility meets the requirements of the subject, that is, the process of defining value. As the evaluation object involves many factors and has a high degree of complexity, it is still difficult to follow a strict and accurate method.

Table 8.1 Comparison of Evaluation Indexes of Logistics Supply Chain

No.	**Previous literature**	**Previous discoveries**	**The deficiency of previous studies**	**The discovery of this thesis and how to expand the previous research**
1	B.M.Beamon. Measuring Supply Chain Performance. International Journal of Operations and Production Management. 1999,19(03):275-292.	The enterprise performance management system is constructed, which includes three aspects, including resources, flexibility and output. The indexes of resources are: manufacturing cost, distribution and sales cost, inventory cost, total cost and return on assets, while the indexes of enterprise flexibility mainly include: product flexibility, quantity flexibility, time flexibility and mixed flexibility; output indexes are: profit, sales, customer response time, order satisfaction rate, manufacturing lead time, just-in-time delivery, delivery	The research focuses on the internal performance of enterprises, but fails to analyze it from the perspective of upstream-enterprise-downstream logistics supply chain.	From the point of view of logistics supply chain, this thesis designs the index system according to the actual design of BJ Company, which is the expansion and practical research of previous studies.

		errors, out of stock and customer complaints.		
2	P.C.Brewer, T.W.Speh. Using Balanced Scorecard to measure Supply Chain Performance. Journal of business logistics, 2000,21(01):75-93.	This thesis puts forward a set of performance management system based on balanced Scorecard for the supply chain management of modern enterprises, and tries to assess the actual performance of supply chain management from four aspects of the enterprise. specifically: 1 the goal of enterprise supply chain management; 2 the actual interests of the final customers of the enterprise; 3 the overall financial interests of the enterprise; 4 the medium-and long-term development of enterprise supply chain management.	The research is based on the theory of balanced Scorecard, but it does not reflect the four principles of logistics: timely, accurate, safe, economic, and does not highlight the characteristics of green, ecological, systematic and innovative.	It not only embodies the four principles of traditional logistics: timely, accurate, safe and economic, but also highlights the characteristics of green, ecological, systematic and innovative. Compared with previous studies, it is more in line with the actual situation of iron and steel logistics enterprises.
3	G.J.Schultz. Keeping SCOR on Your Supply Chain. Basic Operations Reference Model Updates With the Times Information Strategy. Journal of business logistics,2003,19(04): 12-20.	In the SCOR classical model, several comprehensive indexes of general enterprise supply chain performance management are put forward, such as the satisfaction of order and delivery, the flexibility of production and manufacturing, the rapid response time of the whole supply chain, the management cost of enterprise logistics activities, the production efficiency of all kinds of added value, the turnover days of enterprise cash flow, the inventory cycle of enterprise supply turnover and the turnover rate of enterprise assets.	The research focuses on measuring the supply chain performance management of general enterprises, and there is a lack of specific index analysis of iron and steel logistics.	More emphasis is placed on the characteristics of automotive special steel logistics, which not only covers the traditional assessment indexes, but also increases the specific indexes of the industry. Compared with previous studies, it is more in line with the actual situation of iron and steel logistics enterprises.
4	James H. Martina, Bruno Grbac. Using supply chain	The common characteristics of supply chain performance indexes are summarized, such as	Failed to keep pace with the times, and implemented in iron	It highlights the characteristics of green, ecological,

	management to leverage a firm's market orientation[J]. Industrial Marketing Management, 2003(32):25-38.	extensiveness, versatility, testability and consistency.	and steel logistics, high-quality logistics and other related fields.	systematic and innovative, taking into account economic, ecological and social benefits, which enriches the case analysis and practical application research in the field of iron and steel logistics.
5	Editorial. Supply chain management: Theory and applications[J]. European Journal of Operational Research, 2004,159:265-268	It is proposed to measure and evaluate the supply chain from three aspects: resources, output and flexibility.	The assessment indexes are not comprehensive enough, especially the lack of consideration of customer satisfaction.	Measure and evaluate the logistics supply chain from six aspects: integrity, quality, safety, greenness, coordination and efficiency.
6	Mallik S, Harker P T. Coordinaling supply chains with competition: capacity allocation in semiconductor manufacturing[J]. European Journal of Operational Research, 2004,159:330-347.	It is considered that the supply chain performance evaluation should be analyzed from the strategic, tactical and operational aspects, and the planning, resources, manufacturing and delivery factors should be considered.	The evaluation of the study failed to fully take into account customer satisfaction, failed to take into account the fierce competition faced by logistics enterprises in reality, customer-centered is also more in line with the requirements of practice.	More from the perspective of customer satisfaction to evaluate the performance of the logistics supply chain. BJ Company is facing fierce competition in the iron and steel logistics industry, and being customer-centered is more in line with the requirements of practice.
7	Chen Zhixiang. Research on Performance Evaluation index System of Agile	Focusing on the four areas of information, logistics, capital flow and work coordination in inter-enterprise supply and demand coordination, this thesis constructs	Failed to formulate an index system in line with the iron and steel logistics industry.	This set of index system is mainly applicable to the iron and steel logistics industry, especially BJ

	Supply and Demand Coordination [J]. Computer Integrated Manufacturing System, 2004,10 (01): 99-105.	a set of multi-objective scientific and reasonable performance management evaluation system, which is suitable for enterprise performance evaluation of supply and demand coordination in agile supply chain, and further sets up a specific quantitative measurement and calculation method for all kinds of indexes in the system.		company. It is a landing of previous studies.
8	Qu Shengdian. Systematic Research on Supply Chain Performance Evaluation [D]. Harbin Institute of Technology, 2006.05.	Through the empirical study on the performance management of power equipment manufacturing industry, it is pointed out that the degree of excellent performance can be in the following order: customer satisfaction, elasticity, supplier performance, cost and profit. At the same time, the improved balanced Scorecard is used to establish the performance evaluation system model for the enterprise's finance, customer, internal business process, learning and growth. Verify the practicability and effectiveness of the improved balanced scorecard in enterprise performance management evaluation.	Failed to focus on customer satisfaction, quality, efficiency and other aspects. The practical significance and maneuverability are insufficient.	This set of index system focuses more on customer satisfaction, quality, efficiency. It has more practical significance and maneuverability.
9	Ma Shihua, Chen Tiewei. Research on Constituent Elements and Evaluation Methods of Logistics Service Capability based on Supply Chain [J]. Computer Integrated Manufacturing	The overall performance evaluation system of supply chain is constructed, and it is considered that the performance effect of supply chain includes two aspects: customer value and supply chain value.	In addition to customer value and supply chain value, logistics supply chain system is also safe, green, efficient. This is what the research lacks.	The system is expanded to include safety, green, high efficiency. It comprehensively and systematically reflects the service quality composition of the iron and steel logistics industry.

	System-CIMS,2007,15 (04): 744-750.			
10	Ye Fei, Xu Xuejun. Performance Evaluation index System and Evaluation Method of Dynamic Alliance [J]. Theory and Practice of Systems Engineering, 2009 (09): 117-119	Evaluation indexes are divided into supply chain internal evaluation indexes, external evaluation indexes and comprehensive evaluation indexes.	In the modern competitive market environment, it fails to think fully from the perspective of customer satisfaction.	The content of the evaluation is more systematic, which is a supplement and expansion to the previous research.
11	Fan Yuqing. Research on the Integration Mode and Operation Mechanism of Iron and Steel Logistics Resources from the Perspective of Supply and Demand [D]. Beijing Jiaotong University, 2018.06.	The evaluation index system of the integration level of iron and steel logistics resources is constructed. From five aspects: the integration level of iron and steel logistics infrastructure resources, the integration level of iron and steel logistics organization resources, the integration level of iron and steel logistics information resources, the service level of iron and steel logistics and the income level of iron and steel logistics. the evaluation index system of the integration level of iron and steel logistics resources is constructed, and the fuzzy comprehensive evaluation model is used to verify the feasibility of the evaluation system.	The research failed to focus on the process evaluation of iron and steel logistics, especially did not consider safety, quality, customer satisfaction and other aspects; and the research is more limited to the theory, failed to combine the opinions of front-line experts, the index system is not operable and timely.	More emphasis is placed on the process evaluation of iron and steel logistics, with special emphasis on safety, quality, customer satisfaction and other aspects, and combined with the opinions of front-line experts, which makes the research results more operational and timely.
12	Gai Qingxia. Research on Customer Service Quality Satisfaction of Logistics Enterprises [J].	Customer service satisfaction can be used as a standard to measure the quality of products or services provided by logistics enterprises.	Customer satisfaction is important, but it is not comprehensive, and other key factors such as quality,	Customer satisfaction is included in the evaluation indexes, but not limited to this. A more comprehensive consideration of the

	Logistics Engineering and Management, 2019, 41 (04): 59-61+58.		safety, green, efficiency are not taken into account.	performance of the iron and steel logistics industry.

8.3 Deficiency and Future Research Direction

On the basis of investigation and literature research, and of putting forward the pre-evaluation framework of high-quality logistics service quality of automobile special steel, this chapter uses Delphi method and Analytic Hierarchy Process, combined with qualitative and quantitative analysis methods. Finally, determine the automobile special steel quality logistics service quality evaluation index system and its weight. According to the emphasis of the evaluation system, this thesis first puts forward the principles and objectives of evaluation improvement, puts forward suggestions for the optimization of high-quality logistics system, and finally points out the implementation steps and safeguard measures.

However, because Delphi method and Analytic Hierarchy Process rely on the judgment of selected experts, it is a question whether these experts are more representative. Therefore, in future research, we should try to enhance the objectivity of evaluation system without losing the consideration of industry experience. In addition, explore the evaluation and assessment of C5 hazard sources and risk control, C6 safety and security regulations implementation rate, E2 freight information inquiry service, E4 supply chain collaboration rate.

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Appendix 1: Research Questionnaire on Service Quality Evaluation Index of High-quality Logistics of Automobile Special Steel

Mr / Ms,

Hello, we are carrying out a survey on *Research on Logistics Service quality Evaluation indexes of Automobile Special Steel*. Thank you very much for completing this questionnaire in your busy schedule. First of all, this questionnaire is completely anonymous, and there is no right or wrong answer. Please carefully read the questionnaire and fill in each option carefully according to your actual situation. Secondly, this questionnaire is only for academic research and will never be used for other commercial purposes. Finally, thank you again for your cooperation and support to our investigation and research.

Note: high-quality logistics needs to establish high-quality evaluation indexes, which is the further sublimation and improvement of lean logistics and fine logistics. BJ company insists on more than ten years' experience of high-quality logistics service quality, and on this basis, the content of high-quality logistics service roughly covers: integrity, safety, quality, greenness, collaboration, and efficiency. The research object of this project is high-quality logistics, and it is applied to the logistics service of automobile special steel.

(1) Business situation.

1. Do you think the company's existing logistics service evaluation system can meet the work needs?

☐Not at all ☐Basically not ☐So so ☐Basically capable ☐ Absolutely capable

2. Can the logistics assessment index be implemented to the person?

☐Not at all ☐Basically not ☐So so ☐Basically capable ☐ Absolutely capable

3. Is the assessment means used by the company to ensure the quality of logistics reasonable?

☐Totally unreasonable ☐ slightly unreasonable ☐generally reasonable ☐ basically reasonable ☐very reasonable.

4. In the quality of logistics service, do you think the evaluation of "honesty" in the existing system is reasonable?

☐Totally unreasonable ☐ slightly unreasonable ☐generally reasonable ☐ basically reasonable ☐very reasonable.

5. In the quality of logistics service, do you think the evaluation of "safety" in the existing system is reasonable?

☐Totally unreasonable ☐ slightly unreasonable ☐generally reasonable ☐ basically reasonable ☐very reasonable.

6. In the logistics service quality, do you think the evaluation of "quality" in the existing system is reasonable?

☐Totally unreasonable ☐ slightly unreasonable ☐generally reasonable ☐ basically reasonable ☐very reasonable.

7. In the quality of logistics service, do you think the evaluation of "green" in the existing system is reasonable?

☐Totally unreasonable ☐ slightly unreasonable ☐generally reasonable ☐ basically reasonable ☐very reasonable.

8. In the logistics service quality, do you think the evaluation of "synergy" in the existing system is reasonable?

☐Totally unreasonable ☐ slightly unreasonable ☐generally reasonable ☐ basically reasonable ☐very reasonable.

9. In the quality of logistics service, do you think the evaluation of "high efficiency" by the existing system is reasonable?

☐Totally unreasonable ☐ slightly unreasonable ☐generally reasonable ☐ basically reasonable ☐very reasonable.

10. In the high-quality logistics evaluation system, which of the following indexes do you think is necessary, which can be deleted, or what indexes do you have to supplement? (please tick or x in the front box and add on the back line)

Criterion layer	**Index layer**	**Supplementary content**
integrity	☐Completion rate of transport operation plan. ☐Timely return rate. ☐Just-in-time rate of shipment. ☐Delivery error rate of warehousing service. ☐ Loading and unloading operation plan	_____ _____ _____

	completion rate.	
quality	☐Warehousing damage rate. ☐Transportation quality loss rate. ☐ Unqualified rate of loading and unloading tools. ☐ Rate of quality damage in loading and unloading of goods.	_____ _____
safety	☐ Completion rate of security inspection of transportation and hoisting equipment. ☐Operator qualification. ☐ Completion rate of training for security personnel. ☐ Completion rate of blind spots in civil air defense and technical defense. ☐Timely delivery rate of return order. ☐Hazard sources and risk control.	_____ _____ _____
greenness	☐ Recovery of defective products and falling objects. ☐Recycling of protective materials. ☐ Identification and control of environmental factors. ☐ Steel mill-automobile plant-steel mill closed loop return. ☐ Power loss (kilowatt-hour / ten thousand yuan).	_____ _____ _____
collaboration	☐User satisfaction. ☐Freight information inquiry service. ☐Customer service attitude. ☐Speed of customer complaint resolution. ☐collaboration among all aspects of the supply chain.	_____ _____ _____
efficiency	☐warehousing cost. ☐Transportation cost. ☐Circulation and processing cost. ☐Energy consumption control	_____ _____

11. What do you think is the problem that the company needs to improve most in the evaluation of high-quality logistics?

(2) Personal data.

1、Gender：☐Male ☐Female

2、Age：☐below 18 ☐18-25 ☐26-35 ☐36-45 ☐46-55 ☐above 55

3、Education：☐below senior high school ☐High school/technical secondary school ☐Undergraduate / junior college ☐Master's degree or above

4、Your marital status is：☐married ☐unmarried

5、Personal monthly income ： ☐ less than 2000 yuan ☐ 2000-5000 ☐5000-10000 ☐10000-20000 ☐20000-30000 ☐more than 30000 yuan

6、Position ： ☐ First-line operator ☐ Team leader ☐ Middle management ☐Senior management

This is the end of the questionnaire, thank you very much for your participation!

Appendix 2: BJ Patents

涂层布成份分析

裕佳牌 PVC 涂层布 500g/平方米				
物料名称	厂商	规格型号	成分 g	占比 %
涤纶基布	宿迁裕佳	1000D*1000D	188	37.6
糊树脂	内蒙君正	440	120	24
碳酸钙	连云港荣利达	轻质活性钙	20	4
阻燃剂	益阳益化	三氧化二锑	20	4
DOTP	齐鲁蓝帆	国标一级	110	22
环氧大豆油	河北金谷	6.30	21	4.2
偶联剂			15	3
稳定剂	江苏联盛	1010	1.5	0.3
紫外线吸收剂	江苏华力明	531	1.5	0.3
颜色	江苏双乐	BGS	3	0.6
合计			500	100

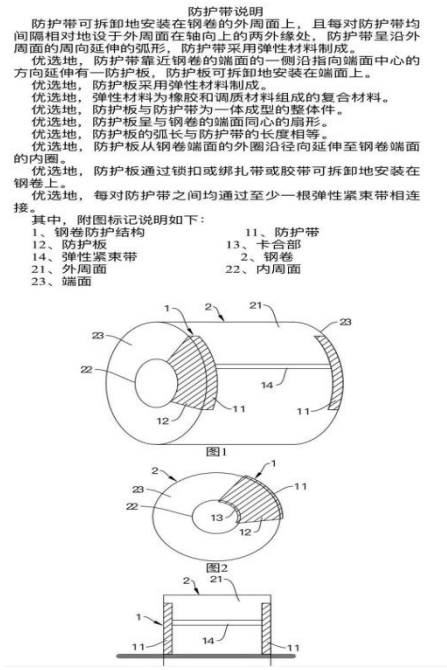
铁科运检字（2019）第 30 号

中国铁道科学研究院集团有限公司运输及经济研究所

检 测 报 告

产品名称：铁路在途汽车钢防护篷布
制造单位：上海中集宝馨集装箱有限公司
委托单位：上海中集宝馨集装箱有限公司
检验类别：委托

报告发送日期：2019 年 6 月 3 日



防护带说明

防护带可拆卸地安装在钢卷的外周面上，且每对防护带均间隔相对地设于外周面在轴向上的两外缘处，防护带呈沿外周面的周向延伸的弧形，防护带采用弹性材料制成。

优选地，防护带靠近钢卷的端面的一侧沿指向端面中心的方向延伸有一防护板，防护板可拆卸地安装在端面上。

优选地，防护板采用弹性材料制成。

优选地，弹性材料为橡胶和调质材料组成的复合材料。

优选地，防护板与防护带为一体成型的整体件。

优选地，防护板呈与钢卷的端面同心的扇形。

优选地，防护板的弧长与防护带的长度相等。

优选地，防护板从钢卷端面的外圈沿径向延伸至钢卷端面的内圈。

优选地，防护板通过锁扣或绑扎带或胶带可拆卸地安装在钢卷上。

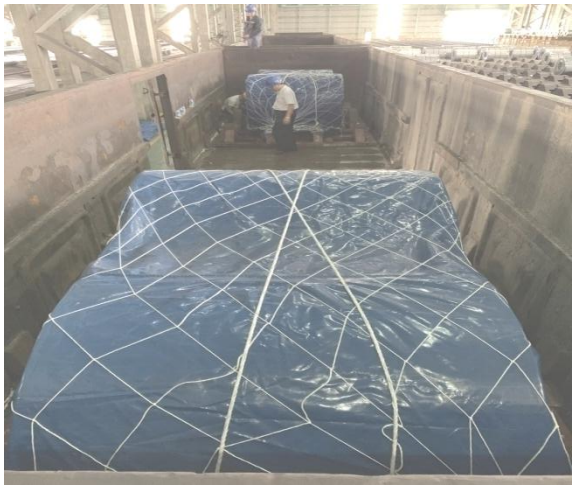
优选地，每对防护带之间均通过至少一根弹性紧束带相连接。

其中，附图标记说明如下：

1、钢卷防护结构　　11、防护带
12、防护板　　13、卡合部
14、弹性紧束带　　2、钢卷
21、外周面　　22、内周面
23、端面

In addition, BJ has successfully developed a new type of automobile steel coil transportation protection system in cooperation with Tongji University. The products have passed the quality inspection of China Railway Research Institute Group Co., Ltd.

Old protective measures



New protective measures.

The new protective measures can effectively prevent rain water's corrosion of steel coil, greatly improve customer satisfaction and reduce goods damage.

In terms of information systems, although the company has information systems, on one hand, it needs to integrate existing information systems, improve system functions, and develop warehousing management systems to cooperate with warehousing and other logistics services. On the other hand, we should properly open the interface of our enterprise system, cooperate with information system companies and key customers, develop a universal and customized information exchange system for road enterprises, and speed up the construction of an open logistics information and data exchange platform. realize zero-distance interaction with external information systems such as customs, local logistics management departments, Hong Kong shipping enterprises, logistics operators, material trade, manufacturing enterprises. Promote logistics cooperation with data resources. Actively use the Wechat official account and other platforms to carry out logistics business inquiry, processing and other services to further improve the capacity and quality of information services.