The Research on Evaluation of BH Airlines Chongqing regional logistics service provider

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With the development of the economy, the logistics industry has been developing rapidly in recent years, and aviation logistics has also received extensive attention. Therefore, airlines need to choose logistics service providers. This study aims to evaluate and analyze the three existing service providers of BH Airlines so that the airline can better manage and select the service providers more suitable for itself by using this method.

Firstly, this paper analyzes the current situation of airlines, and at the same time analyzes the current situation of logistics. From the perspective of airlines, an evaluation system is established for the needs of airlines, and the weights are calculated using the analytic hierarchy process. And the evaluation analysis of the existing three service providers, combined with the weight of the evaluation system, and the ranking of the three service providers shows that service provider F1 is better than the other two. At the same time to analyze, analyze the shortcomings so can better manage them. At last, a return survey was carried out to ensure the feasibility of the method.

Through the study of this paper, we can know that it is feasible to use AHP to analyze air logistics service providers, and it can quickly help airlines choose the right service providers, and at the same time, we can know what aspects need to be improved. In the future, it can be adjusted based on this method to make its results more in line with the development of BH Airlines.

Keywords
Logistics service provider; Analytic hierarchy process; Aviation logistics

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1 Introduction

This chapter mainly introduces the research background, purpose, and significance of this paper, and analyzes the current situation from the aspects of air cargo, logistics service providers, and hierarchical analysis. Have a preliminary understanding of the object to be studied, prepare for the following research work, understand the current situation, and clear research problems.

1.1 Research Background

In recent years, with the rapid development of logistics, aviation logistics is more and more attention. The logistics service provider is an important supporter of third-party logistics services in the aviation industry, and its position in the airline is very important. Compared with other traditional transportation modes such as sea freight, railway freight, and road freight, air freight has obvious advantages such as fast transportation time, high stability, and safety, but it also has the highest transportation cost. With the rapid progress of science and technology, the upgrading of domestic consumption, and other factors, cargo transportation efficiency requirements are constantly improving, giving air cargo great development opportunities. At the same time, with the municipal Party committee and municipal government the implementation of the policy, the development of logistics, Chongqing regional aviation logistics has developed rapidly.

In 2022, the cargo throughput of Chongqing Jiangbei Airport decreased by 13% compared with 2021, but the throughput of 414,775.41 tons, the growth rate ranked 8th in China. The increase is shown in Figure 1.

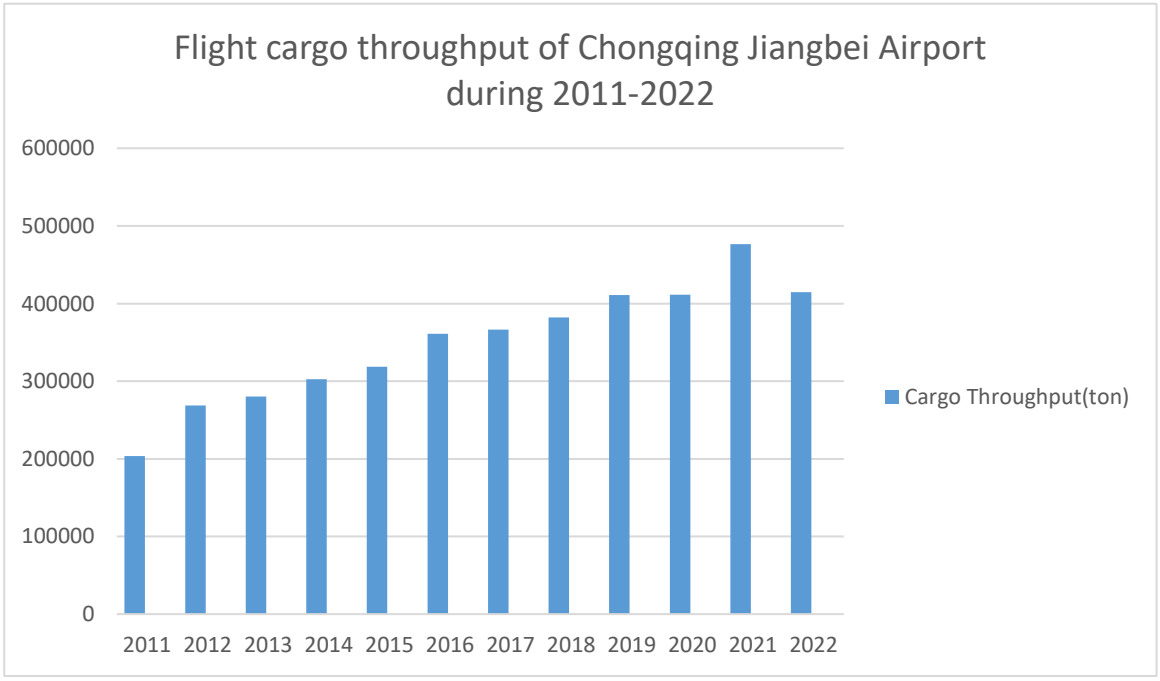

Figure 1.（This table is adapted from www.huaon.com）

With the increase in regional air cargo throughput in Chongqing, BH Airlines attaches more importance to the selection of logistics service providers. It needs to evaluate and study the service providers to select the service providers more suitable for themselves, improve transport efficiency, and reduce transport costs.

1.2 Research Purpose and Significate

The content and question of this paper are introduced from two aspects of purpose and significance respectively.

1.2.1 Purpose

The logistics service provider is an essential supporter of third-party logistics services in the aviation industry, and its position in the airline is very important.
In the process of selection and management of logistics service providers of airlines, there are many problems that we need to think about, such as how to evaluate and select logistics service providers to achieve a win-win situation, cooperation with one or more logistics service providers and other issues need us to analyze and study from multiple perspectives, to form a set of evaluation system suitable for the service providers. This is important for airlines and is also the purpose of this article.
Although the logistics service provider in Chongqing is developing well for BH Airlines, there are still some problems. The purpose of this project is to analyze the logistics status of BH Airlines and use the analytic hierarchy process to evaluate and analyze the logistics service providers of BH Airlines in Chongqing, to help the company better select and manage service providers.

1.2.2 Significance

Aviation logistics has the advantages of high speed and saving the total cost of the supply chain. It has become a driving force for the sustained growth and healthy development of the world economy. All countries regard the development of aviation logistics as an effective means to improve the level of economic development and enhance competitiveness. Therefore, it is necessary to choose a suitable logistics service provider. And the use of a hierarchical analysis evaluation system, this method has been proved in practice, to be a feasible method.
The working efficiency of service providers is very important for airlines and affects the overall working process of airlines. Therefore, the evaluation and selection of logistics providers are very important for airlines. This paper can help BH Airlines to establish an evaluation system, better manage service providers, improve the logistics operation efficiency of the airline in Chongqing, and effectively reduce costs and increase profits. It can also promote cooperation between airlines and service providers so that the interests of both sides are greater.

1.3 Research Contents and Methods

This part mainly introduces the research content and research methods.

1.3.1 Research Contents

The main research question is to help BH Airlines establish an evaluation system, evaluate and analyze the existing service providers, and enable the company to better manage them. Therefore, the main contents of this paper are as follows:
(1) Analyze BH Airlines, get familiar with its current situation and its demand for logistics service providers, and learn about the existing three service providers.
(2) Establish an evaluation system based on the obtained information by using an analytic hierarchy Process (AHP) to evaluate and study the service providers.
(3) Pay a return visit to the airline company to investigate the feasibility of this evaluation method to make BH Air's logistics service in Chongqing more efficient.

1.3.2 Research Methods

The main research methods of this paper are field investigation and analytic hierarchy process. Use the company's official information to get airline staff phone numbers, call him and explain the intention, set a good time to go to the company for two days, three hours a day of research, mainly led by the staff who have established contact with the service provider, visit the company, and communicate with the person in charge, so as to master the actual situation.
Through the person in charge of the logistics service provider of BH Airlines, I contacted three logistics service providers of the company and went to do field research. I went to one service provider every day for two hours to understand the current situation of the three service providers.
The analytic hierarchy process (AHP) should formulate the evaluation criteria of BH Airlines based on the opinions provided by the person in charge of the logistics service provider and the existing service providers. Besides, we contacted experts of logistics service providers through BH Airline's recommendation, formulated questionnaires, and sent them to experts for scoring.

1.3.3 Research Ideas

The first chapter mainly introduces the research background, content, and research methods, and puts forward the research problems; The second chapter by searching the literature to write the research status; Then through the official website information and field research to analyze the company's current situation; The fifth chapter combines the existing standards, formulates the evaluation standards that meet the company, establishes the index system, and evaluates the service providers by scoring by experts; Finally, return to the survey.

The overall research idea of this paper is shown in the figure2 below:

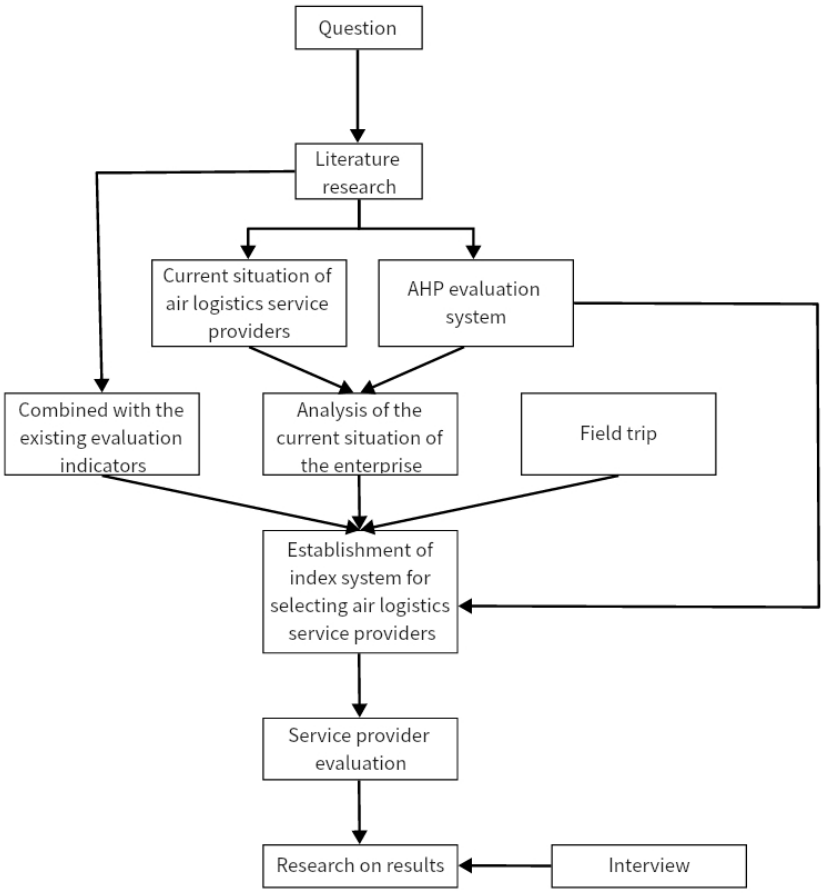

Figure 2. Flowchart of the paper

1.4 Summary

Through the research in this chapter, it can be known that the problem studied in this paper is to help BH Airlines evaluate and analyze its existing service providers. As for research methods, the analytic hierarchy process (AHP) and its development are mature and complete, and the application of AHP in articles is also numerous. Therefore, these literature reviews can help us better use AHP.

In addition, the method and content of the research are defined, mainly using field research method and analytic hierarchy process, and specific research ideas are obtained, which can make the paper proceed smoothly.

2 Research Status

Referring to the literature on the evaluation and selection of aviation logistics service providers, there is more information on the selection and study of aviation logistics service providers, but less information on the evaluation of aviation logistics service providers. Therefore, this paper mainly draws on the research results and methods from the current situation of air cargo, air logistics service providers, air cargo selection, and evaluation.

2.1 Research Status of Air Cargo

In the 1980s, the country carried out reform and opening up, the national economy grew steadily, the people's living standard was improved day by day, the political situation was stable, and foreign trade expanded, which effectively promoted the development of air freight. In terms of the development of the Chinese air cargo logistics industry, it is found that since the eleventh Five-Year Plan, the state attaches more importance to the air cargo industry year by year. Lv Zongping (2000) mentioned that the air cargo industry of Civil Aviation in China has also begun to take shape, and a professional cargo team has been initially formed. From the perspective of civil aviation development, the development of air cargo is an important way to make full use of the existing transport capacity and improve the flight load rate, and economic benefits. The thesis of Fang Wenqing(2009) gives a comprehensive evaluation of the efficiency of Chinese air cargo transport. The results show that air cargo transportation generally has the phenomenon of increasing returns of scale, increasing investment can obtain better output, which also shows that our air cargo industry is not sufficiently input on the whole from the other hand. China is currently in an air freight network controlled by megacities. Air freight is concentrated in economically developed cities in the eastern region and provincial capitals in the central and western regions, air freight is concentrated from a single city to an urban cluster, and the coupling association between air freight and the urban system is gradually strengthened. (Geographical Science 2010,489-495) As can be seen from the paper written by Xu et al. (2011), Chongqing Air Cargo not only achieved a huge leap compared with its performance in the same period but also laid a solid foundation for the international cargo of Great Southern Airlines to open the south-west market and accelerate the strategic transformation. Li Fei(2020) proposed that there are certain problems in the development of air logistics in Chongqing: low proportion of air cargo structure, unbalanced air cargo capacity, and the efficiency of air logistics service to be improved. In the paper published by Li Wei(2022), based on the current situation of the cargo business of G Airlines, he selected and innovated service quality evaluation indexes using reading and analyzing literature and sorting out service processes, to establish a scientific air cargo service quality index system, and finally determined 5 evaluation dimensions and 24 evaluation indexes.

2.2 Research Status of Logistics Service Providers

In Europe and the United States and other regions, aviation service providers have developed into mature third-party logistics companies, and aviation logistics freight forwarding companies, and many have been listed. Japan's air cargo industry is also booming. The academic community draws on the performance evaluation theory of developed countries in Europe and the United States and combines its characteristics, to sum up a set of aviation logistics management theories suitable for the actual situation of Japan.

Sepulveda(2013) wrote that supplier management is critical to improving the company's efficiency at the operational, functional, economic, and financial levels and the efficiency embedded in the supply chain. In the paper published by Ding Yan and Geng Ruhua(2017), they used factor analysis, data envelopment analysis, and analytic hierarchy process to analyze actual cases based on Ying Wang et al., found key evaluation indicators based on factor analysis, and established DEA/AHP evaluation model based on fac-tor analysis to evaluate actual cases and select the optimal third-party logistics service provider. Obtaining more accurate evaluation results has practical guiding significance for enterprises to implement logistics outsourcing. Gupta, et al. (2018) proposed a comprehensive framework for evaluating logistics supplier services in their work. Zhao Yizhe(2021), published a paper that clarified the external purpose and capability requirements of transport services and constructed the selection and evaluation system of transport service providers. Lin Ling(2022) summarized the existing problems in the selection of logistics service providers in the article, which mainly involved: the selection and evaluation principle of logistics service providers ignored supply chain management, the selection index of logistics service providers was not scientific enough, the index system was not perfect, the information of logistics service providers was not updated in real-time, and the supervision was not in place. At the same time, logistics service providers' principles, requirements, steps, and methods in selecting indicators are determined, and the evaluation system is optimized.

He Jianbin(2007) adopted five index systems, namely transportation capacity, storage capacity, inventory management, informatization level, and development potential, to establish evaluation criteria when evaluating the third-party logistics service providers, and finally evaluated the four service providers. Huang Jiaofei(2010) used the four weight indicators of financial status, management level, service level, and public relations to evaluate the four air logistics service providers, and finally selected the best third-party air logistics service provider. Tao Xipei(2019) chose service quality, service cost, and service capability to build an index system when evaluating and selecting third-party logistics service providers, to select more suitable service providers. It can be seen that the existing standards are more focused on logistics and transportation and service quality.

As can be seen from the above literature, the performance evaluation of logistics service providers has been dramatically developed in theoretical research and practical application in recent years.

2.3 AHP Evaluation System

The analytic hierarchy process (AHP) is a commonly used method in the research literature on the selection of logistics service providers and logistics, and it is mainly involved in the reference literature used in this paper.

In the early 1970s, Professor Satie, an American operations research scientist from the University of Pittsburgh, applied the network system theory and the multi-objective comprehensive evaluation method and proposed a hierarchical weight decision analysis method when studying the topic of "Power distribution according to the contribution of each industrial sector to the national welfare" for the United States Department of Defense.

Guo Jinyu et al.(2008) concluded in their published works that the Analytic Hierarchy Process (AHP) is not only widely used in safety science research and environmental research but also provides a scientific basis for decision-makers to make correct decisions in the face of complicated situations in other fields. The analytic hierarchy process (AHP) has the advantage of combining qualitative and quantitative analysis. It can decompose complex problems into the choice of the best scheme and provide a scientific basis for the decision-making layer to make the right decision. Chen Xiulan(2006) expounded on the application of the analytic Hierarchy Process (AHP) and proved through examples that AHP could be more widely applied in our real life, which effectively solved many decision-making problems in reality and became an essential decision-making tool. In the article published by Yao Qian(2010), AHP was used to study how to select logistics service providers, and it was concluded that AHP was used to conduct quantitative analysis of non-quantitative events and to evaluate and select third-party logistics service providers. Compared with other methods, this method was simple, easy to implement, and highly operational. Peng(2012)analyzes the characteristics of the logistics outsourcing industry, and it is more targeted and practical to construct the AHP evaluation index system including logistics cost, logistics operation efficiency, basic quality of service providers, and logistics technical level. The application of AHP and other methods proposed by Jayant et al.(2014) can well guide policymakers to evaluate third-party logistics reverse logistics service providers and support them to visualize the intensity of the influence of various standards on available alternatives before making final decisions. The paper published by Wang Zhanhai and Liang Gongqian(2017), this paper constructed the selection model of enterprise logistics service providers, calculated the local weight and global weight among various indicators, and combined with AHP and other methods to select suppliers, and proved the feasibility of this method through numerical examples. Gurcan et al.(2016) used AHP to select the most suitable third-party logistics service provider. Jiang Tongqiang et al.(2019) took Ande Zhaopin as an example and selected the most suitable enterprise from four service providers by using an analytic hier-

archy process. Zhao Yizhe(2021) used the analytic hierarchy process (AHP) in his paper to construct the selection and evaluation system of transport service providers and select the most suitable service providers for the company.

2.4 Summary

With the growth of the economy, the development of air freight is getting better and better, and the country attaches more and more importance to the development of the aviation industry, but it still needs to strengthen the construction and management of air logistics. The evaluation system of air logistics service providers has been gradually improved, but there are also some deficiencies. It is still necessary to select and evaluate service providers according to the needs of airlines. According to the literature analysis, it can be seen that it is effective to use AHP to study the evaluation of logistics service providers, which can display the evaluation of logistics service providers scientifically, reasonably, and effectively. Therefore, this paper hopes to establish an evaluation system for the service provider by applying the analytic hierarchy process (AHP) to the needs of airlines, to better manage the service providers.

3 BH Airlines Current Situation Analysis

This chapter mainly introduces the status quo of BH Airlines, understands the current development status and logistics status of the company, analyzes the existing three service providers, and has a better understanding of the company and its service providers, laying the groundwork for the following analytic hierarchy process.

3.1 BH Airlines Development Status

BH Airlines was founded in 2007. After more than ten years of development, it has 30 Airbus aircraft, opened 59 routes, and is constantly optimizing. The company is well known in China's civil aviation industry for its unique positioning and robust hardware and software advantages in plateau and high plateau flight. BH Air's service philosophy is "passion, efficiency and responsibility", bringing a quality experience to customers.

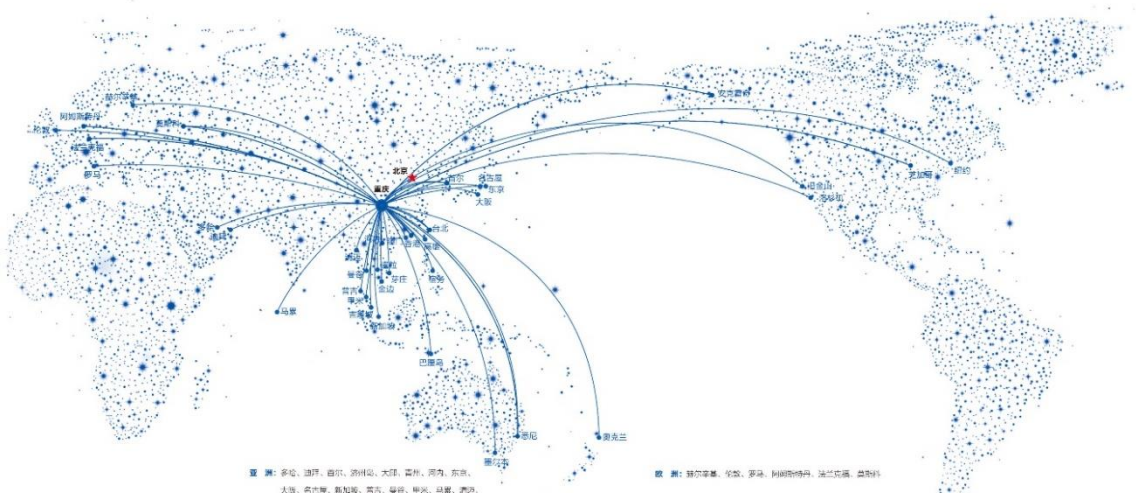

Figure 3. Course chart (Photo source: 2016 Corporate Social Responsibility Report of Chongqing Airport Group Co., LTD.)

BH Airlines' development is going from strength to strength thanks to the cooperation between Chinese aviation enterprises and large state-owned investment companies. In addition, relying on the solid support of China Southern Airlines, BH Airlines has a first-class flight operation control system, which provides a more powerful guarantee for the safe operation of the company. At the same time, BH Airlines has always been active in fulfilling its social responsibility, taking the initiative to carry out public welfare activities and volunteer service projects, and providing special flight support services for earthquake relief and poverty alleviation.

BH Airlines actively responds to green flight, adheres to sustainable development, and attaches importance to low carbon and environmental protection. Therefore, the sustainable development capacity of service providers will be valued.

(Data has taken from CQAirline's website. URL: https://www.chongqingairlines.cn/contactus/ Accessed: 20 April 2023)

3.2 BH Airlines Logistics Status

Through the logistics characteristics and development of the company to analyze its current situation.

3.2.1 Logistics Characteristics

Expand the sales market of the whole transport aircraft business process, promote the "ground idling" business process, take the initiative to develop the "air-to-air transfer" business process, and integrate the resources of civil aircraft belly cabin, truck and aircraft flight, cargo logistics and aircraft flight, build the information content data sharing platform, and improve the digital and information management level of air logistics.

In the annual international cargo throughput, a large part of the pen products shipped to Europe and America. The industrial structure of Chongqing is constantly improving, the demand for aviation is growing, and there are national and provincial industrial parks near the airport.

Export products are characterized by high added value, fast upgrading, and high product integration. Therefore, to accelerate the speed, these enterprises will have higher and higher requirements for logistics. At the same time, it also provides a great space for the development of aviation logistics.

3.2.2 Logistics Development

As an inland city in China, Chongqing has developed rapidly in the aspect of air logistics transportation.

Before and after the epidemic, BH's air transport industry bucked the trend and opened five international cargo routes. They are Chongqing-Yekaterinburg-Brussels, Bengaluru -- Chongqing, Chongqing-Nantong -- Tokyo, Chongqing-Dhaka, and Chongqing-Krasnoyarsk international cargo lines.

The cargo throughput kept increasing and the supportive policies for the development of cargo further stimulated the input of market players. At the same time, the optimization of Chongqing's regional economic structure and the upgrading of the industrial chain led to increased demand, thus increasing the volume of air cargo.

The scale of the air cargo business continues to grow, and the coverage of cargo service projects continues to improve. Air cargo service projects are more cost-effective. With the development of cooperation, logistics efficiency is gradually improved, and waterway transport efficiency and management quality are significantly improved.

(Data has taken from CQA's website. URL: https://www.cqa.cn/index/. Accessed: 20 April 2023)

3.2.3 Current Situation of Logistics Service Provider

BH Airlines has three logistics service providers. Although the scale is not large, it has great development potential. It mainly focuses on basic business such as transportation and warehousing, but its development strategy is not clear and it lacks certain management. Each of the three service providers has its characteristics.

Service provider F1 attaches importance to sustainable development and actively responds to energy conservation and emission reduction, on a larger scale than the other two. According to the interview, the overall development of this service provider is good.

Service provider F2 has greatly improved its transportation efficiency. After the epidemic, it quickly recovered to the previous level and is constantly getting better. This service provider has been established for the longest time and is more mature in terms of management. However, during the visit, the environment of the service provider was found to be relatively old.

Service provider F3 is the newest service provider among them. It is relatively average in all aspects, but it needs to be managed more.

The comparison of other indicators of the three service providers is shown in the following:

Table 1. Comparison of three service providers

	Establishment time	Registered capital	Number of employees
F1	2008	300million	50
F2	2002	400million	62
F3	2018	350million	45

3.3 Summary

In general, BH Air is constantly developing, cooperating with other companies to make it better, and responding to the policy of green flying actively. In terms of logistics, project coverage increases and throughput keeps rising, so we pay more attention to service providers. We want to better manage service providers so that the development of the company can increase steadily and ensure that every shipment can be carried out perfectly.

The existing three service providers have their characteristics, but there are also obvious shortcomings, such as improper management, and the general environment.

Therefore, in the subsequent evaluation, the evaluation index can be established for the service provider according to the needs of BH Airlines.

4 BH Airlines Logistics Service Provider Evaluation

This chapter mainly evaluates and analyzes the existing service providers of BH Airlines. Firstly, it selects the evaluation method and defines the evaluation steps. Establish an evaluation index for logistics service providers, construct a hierarchy, and score them. Then, the existing service providers are scored through questionnaires to determine the weight and evaluate the research.

4.1 Select Evaluation Method

The appropriate evaluation method is selected by considering the factors, and the application of this method is simply described.

4.1.1 Considerations

When evaluating BH Airlines' logistics service provider, the following factors should be considered:
(1) Evaluation purpose.
According to the needs of airlines, choose the appropriate evaluation method. BH Airlines hopes to make an evaluation quickly and analyze the existing service providers in the shortest time. Therefore, this paper adopts the evaluation method that is relatively easy to master.
(2) Evaluation personnel.
With the recommendation of BH Airlines, three professionals with quality and relevant work experience are selected from the logistics department of BH Airlines and SF Logistics Company respectively. Only in this way can the score be accurate and the evaluation can be carried out more effectively.
(3) The source of data.
The source of data is mainly the information obtained from the company's official website and field research so that the data obtained is more reliable and the information obtained can be applied to the selected evaluation method.

4.1.2 Analytic Hierarchy Process

Based on the above considerations and the requirements of BH Airlines, it is necessary to select and evaluate air logistics service providers every year. Therefore, the analytic hierarchy process (AHP) is adopted to evaluate and analyze the service providers of BH Airlines.
The Analytic Hierarchy Process (AHP) was established by American scholar A.L. Suaty in the 1970s. This method is simple, efficient, and practical, so it has been widely used.
In the analytic hierarchy process, the objective of the problem is first determined, and then the objective is decomposed into multiple criterion levels, and the criterion levels are further decomposed into multiple selection levels. Finally, the optimal scheme is obtained by comparing the importance

of different levels. Because of its advantages of simple operation and quantitative qualitative indicators, it is often used in the field of service provider evaluation and is the most common evaluation method.

4.2 Evaluation Step

The evaluation procedures include clear evaluation objectives and principles, the establishment of evaluation indicators, expert group scores, and determining the weight of indicators. The specific process is shown in the following:

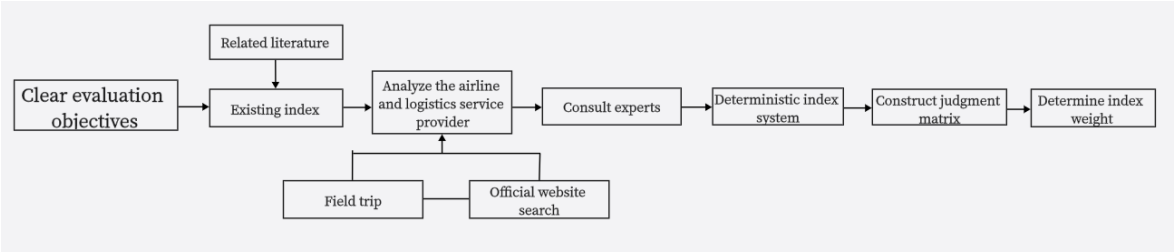

Figure 4. Evaluation steps

(1) Clear evaluation objectives

Through field research, BH Airlines' requirements for logistics service providers are clarified. The evaluation system is designed to enable the company to better evaluate the existing service providers and better manage them. Meanwhile, when choosing other service providers, it can select suitable service providers more efficiently and improve efficiency.

The evaluation index system should focus on the needs of BH Airlines.

(2) Establish evaluation indicators

The existing evaluation index is combined with the demand of BH company, and the evaluation index is established according to the opinions of experts. Reference to the benchmark-ing logistics enterprises in the same industry, considering their factors to establish a scoring standard.

(3) Expert group score

BH Company sets up an expert rating group, which consists of five members, namely two service provider managers of BH Airlines, two staff members of SF Logistics company, and one expert related to air cargo. Questionnaires are sent to them through the online questionnaire mode, and they score the evaluation indicators according to the company's needs. The results are more in line with the wishes of BH Airlines.

(4) Determine index weights

The expert group scores to determine the weight of indicators.

4.3 Determine Evaluation Index

According to the literature search and the field research on the second day, the evaluation criteria found in the literature were provided to the employees of the company. Based on this, BH will provide the evaluation criteria that they think are more suitable for the company. For transportation, the company pays more attention to efficiency and cost, including transportation speed, accuracy, and stability, as well as logistics costs, labor costs, and energy costs. In terms of service quality, BH Airlines focuses more on customer service, problem-solving ability, and feedback mechanisms. BH Airlines also believes that information technology capability is particularly important. It attaches great importance to data collection and logistics tracking, which can greatly improve the efficiency of logistics transportation.

In addition, BH Airlines also values the sustainable development of its service providers. Sustainable development is divided into environmental protection and social responsibility. Currently, the country is vigorously advocating sustainable development, which is often reflected in the aviation industry. BH Airlines, therefore, values the sustainability of the service provider.

So you can build the following metrics:

Table 2. Evaluation criteria

Evaluation index	Transport efficiency （BH company proposed）	Transport speed （BH company proposed）
		Transportation accuracy （Li Wei，2022）
		Transport stability （Li Wei，2022）
	Transportation cost （BH company proposed）	Logistics cost （Wang Zhenzhen，2022）
		Labor cost （Huang Jiaofei，2010）
		Energy cost （BH company proposed）
	Service quality （Wang Zhenzhen,2022）	Customer service （BH company proposed）
		Problem solving （Wang Zhenzhen，2022；BH company proposed）
		Feedback mechanism

		（Li Wei，2022）
	Sustainability （BH company proposed）	Environmental protection （BH company proposed）
		Social responsibility （BH company proposed）
	Information technology（Li Wei，2022）	Data acquisition （BH company proposed）
		Logistics tracking （BH company proposed）
		Information sharing （Huang Jiaofei，2010）

4.4 Specific Process

The specific process is divided into the following three steps

4.4.1 Building the Hierarchy

According to the 4.3, a hierarchical structure model was established. As shown in the picture below:

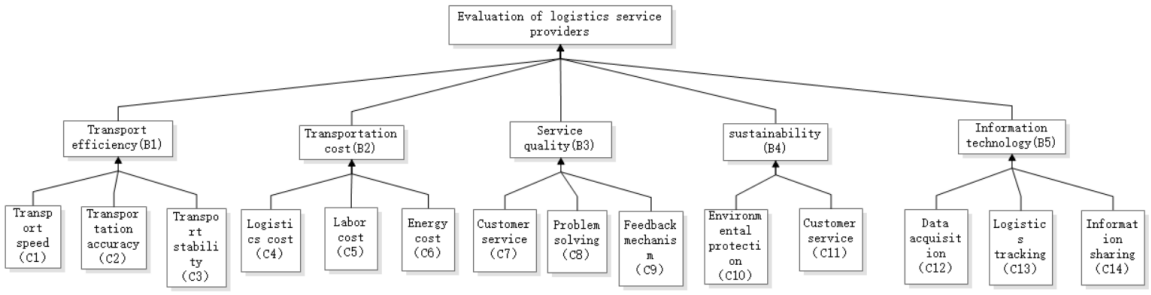

Figure 5. Establishment of evaluation indicators

4.4.2 Determine the Judgment Matrix and Target Weight

In AHP analysis, it is necessary to establish a judgment matrix between different levels, to reflect the importance of comparison between different levels.

The judgment matrix is the core of the AHP method, used to compare the importance of each level. Compare the elements at each level in pairs to determine how important they are to each other.

Table 3. Quantified values are specified for comparison between indicators

Factor i versus Factor j	Quantized value
Equally important	1
Slightly important	3
More important	5
Strongly important	7
Extremely important	9
The median value of two adjacent judgments	2,4,6,8
Reciprocal	$a_{ij}=1/a_{ij}$

Through field research, this study discussed with two logistics personnel of BH Airlines on the second day of the investigation. According to the quantification value of the comparison between indicators, the evaluation was made according to the slightly important and stronger important values, the judgment matrix was constructed, and the weight of the indicators was calculated as shown in the following chart:

The arithmetic average method is used to calculate the weight. The weight means the score of the importance of each factor at this level to the evaluation target at the level in which it is located, that is, the importance it occupies. The greater the weight, the more important the factor is.

First, calculate the sum of each column: 1+1/2+1/3+1/2+1/3=2.667 2.66. Similarly, the sum of the remaining four columns is 4.333,8.5,8.5,8.5 respectively.

Then, by dividing each row by each column, the behavior of transportation efficiency is taken as an example:

1/2.667=0.3750

2/5.732=0.4619

3/8.5=0.3529

2/8.5=0.2352

3/8.5=0.3529

Calculate the weight of the other layers in the same way, and then calculate the eigenvalue λ, which is used to check the consistency.

The calculation formula is: $\lambda_{max}=\sum_{i=1}^{n}\frac{[A\omega]_i}{n\omega_i}$

The calculation process is as follows:

Firstly, Aω is calculated by weight ω_i, and then multiplied by the judgment matrix of each line respectively. Take transportation efficiency as an example:

1*0.3555+2*0.3555+3*0.3555+2*0.3555=3.9105

Other lines of A similarly calculated for omega: 2.1114, 0.5650, 0.5858, 0.5650,

λ_{max} =5.3921 can be obtained by substituting into the formula

Table 4. Evaluation matrix of logistics service provider and determination of its weight

	Transport efficiency	Transportation cost	Service quality	Sustainability	Information technology	ω_i	
Transport efficiency	1	2	3	2	3	0.3555	λ_{max}=5.3921
Transportation cost	1/2	1	2	3	2	0.2484	
Service quality	1/3	1/2	1	2	1/2	0.1304	
Sustainability	1/2	1/3	1/2	1	2	0.1352	
Information technology	1/3	1/2	2	1/2	1	0.1304	

Table 5. Transportation efficiency judgment matrix and weight determination

	Transport speed	Transportation accuracy	Transport stability	ω_i	
Transport speed	1	3	2	0.5390	λ_{max}=3.0092
Transportation accuracy	1/3	1	1/2	0.1638	
Transport stability	1/2	2	1	0.2973	

Table 6. Transportation cost matrix and determination of its weight

	Logistics cost	Labor cost	Energy cost	ω_i	
Logistics cost	1	3	5	0.6479	λ_{max}=3.0037
Labor cost	1/3	1	2	0.2299	
Energy cost	1/5	1/2	1	0.1222	

Table 7. Service quality matrix and determination of its weight

	Customer service	Problem solving	Feedback mechanism	ω_i	
Customer service	1	3	5	0.6333	λ_{max}=3.0387
Problem solving	1/3	1	3	0.2605	
Feedback mechanism	1/5	1/3	1	0.1062	

Table 8. Sustainability matrix and determination of its weight

	Environmental protection	Social responsibility	ω_i	
Environmental protection	1	3	0.7500	$\lambda_{max}=2.0000$
Social responsibility	1/3	1	0.2500	

Table 9. Information technology matrix and determination of its weight

	Data source	Logistics tracking	Information sharing	ω_i	
Data source	1	3	5	0.6333	$\lambda_{max}=3.0387$
Logistics tracking	1/3	1	3	0.2605	
Information sharing	1/5	1/3	1	0.1062	

It is concluded that the ranking weight of the first intermediate layer factor on the decision target is：

Table 10. Middle layer weight sort

	Weight
Transport efficiency	0.3555
Transportation cost	0.2484
Sustainability	0.1352
Information technology	0.1304
Service quality	0.1304

By multiplying the weight of each element in the scheme layer with the ranking weight of the elements in the middle layer on the decision target, the ranking weight of the elements in the scheme layer on the decision target can be obtained.

For example, if the weight of transportation speed is 0.539 and the weight of transportation efficiency on the decision target is 0.355, it can be obtained that the weight of transportation speed on the scheme layer is 0.539*0.355=0.1916.

Thus, the ranking weight of scheme layer elements on decision objectives can be obtained as shown in the table below:

Table 11. Scheme layer weight sort

	Weight
Transport speed	0.1916
Logistics cost	0.1609
Transport stability	0.1507
Environmental protection	0.1014
Customer service	0.0826
Data source	0.0826
Transportation accuracy	0.0582
Labor cost	0.0571
Logistics tracking	0.0340
Problem solving	0.0340
Social responsibility	0.0338
Energy cost	0.0303
Information sharing	0.0138
Feedback mechanism	0.0138

Based on the above information, the following conclusions can be drawn:
In Chongqing, BH Airlines pays more attention to transport efficiency, transport cost, and sustainability, among which, it pays more attention to transport speed, logistics cost, transport stability, and environmental protection. Therefore, when choosing logistics service providers, we can pay more attention to these aspects to choose the service providers consistent with the company's wishes. At the same time, it can also evaluate the existing service providers according to their weights.
In addition, the parts with lower weight ranking can not be ignored, but also need to develop vigorously, so that each part is in an important position.

4.4.3 Consistency Test

Considering that the deviation of consistency may be caused by random reasons, it is necessary to compare CI and random consistency index RI to obtain the test coefficient CR when verifying whether the judgment matrix has satisfactory consistency.
According to the formula$CI = \frac{\lambda_{max}-n}{n-1}$, the monotonic index of each table can be calculated, and n is the dimension of the matrix. Then find out the corresponding evaluation random consistency index RI, as shown in the table below, calculate the consistency ratio CR=CI/RI, if CR<0.1, it can be considered that the consistency of the judgment matrix is acceptable; otherwise, the judgment matrix needs to be corrected.

Table 12. Random consistency index

n	1	2	3	4	5	6	7	8	9	10	11
RI	0	0	0.52	0.89	1.11	1.26	1.36	1.41	1.46	1.49	1.52

Taking Table 5. as an example, λmax=3.0092, n=3, then CI=0.0046, corresponding to Table 4.4, RI=0.52, CR=0.0046/0.52=0.0088. So the CR<0.1, the matrix conforms to consistency.
By the same token, we can conclude:

Table 13. Consistency test result

Evaluation of logistics service providers	CR=0.0875
Transport efficiency	CR=0.0088
Transportation cost	CR=0.0036
Service quality	CR=0.0372
Sustainability	CR=0.0000
Information technology	CR=0.0372

It can be seen that this result conforms to the consistency test. Therefore, the evaluation results are accurate, and the calculated weights can reflect the importance BH Airlines attaches to these criteria.

4.5 Establishment of Evaluation Model for Logistics Service Providers

Based on the above content, the weight of existing standards is obtained. Therefore, the weight of existing standards is utilized to evaluate and analyze the three service providers. The specific process is as follows:

(1) The hierarchy diagram created is shown below:

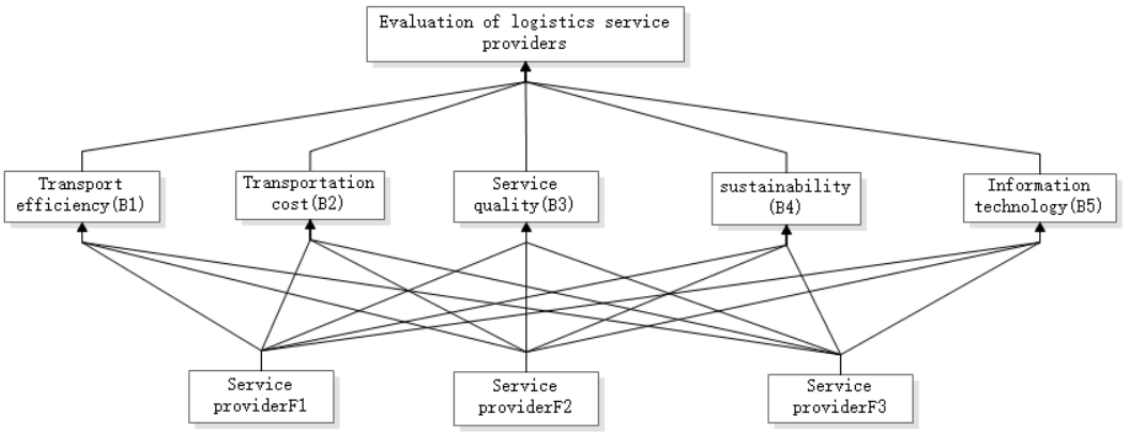

Figure 6. Service provider evaluation index

(2) Expert rating:

See Annex 1 for details of the scoring

(3) Establish judgment matrix and consistency test

Based on the above average values, the judgment matrix is constructed and consistency test is conducted, as shown in the following table:

Table 13. Judgment matrix B1

B1	F1	F2	F3	Wi
F1	1	0.913	0.955	0.3182
F2	1.0953	1	1.045	0.3484
F3	1.0471	0.9569	1	0.3333

CR<0.1, the consistency test passed

Table 14. Judgment matrix B2

B2	F1	F2	F3	Wi
F1	1	1.048	1.1	0.3492
F2	0.9542	1	1.05	0.3333
F3	0.9091	0.9524	1	0.3175

CR<0.1, the consistency test passed

Table 15. Judgment matrix B3

B3	F1	F2	F3	Wi
F1	1	1	1.048	0.3385
F2	1	1	1.048	0.3385
F3	0.9542	0.9569	1	0.3230

CR<0.1, the consistency test passed

Table 16. Judgment matrix B4

B4	F1	F2	F3	Wi
F1	1	1.176	1	0.3508
F2	0.8503	1	0.85	0.2983
F3	1	1.1765	1	0.3509

CR<0.1, the consistency test passed

Table 17. Judgment matrix B5

B5	F1	F2	F3	Wi
F1	1	1	1.1	0.3438
F2	1	1	1.1	0.3438
F3	0.9091	0.9091	1	0.3125

CR<0.1, the consistency test passed

(4) Total hierarchical sorting

Combined with the ranking weight of the elements of the middle layer on the decision objectives, it can be concluded that:

Table 18. Final weight sort

Service provider	Weight	Sort
F1	0.3363	1
F2	0.3360	2
F3	0.3277	3

It can be seen that the service provider F1>F2>F3, so the overall effect of the service provider F1 is better. F3 needs to be optimized and adjusted.

4.6 Summary

Through the ranking of weights, we can know that BH Airlines pays more attention to transportation efficiency, transportation cost, and sustainability so that it can be more clear about its needs when choosing service providers.

According to expert opinions, this chapter can evaluate service providers well by using the analytic hierarchy process, evaluate and analyze the existing three service providers, and conclude that service provider F1 is better than the other two. At the same time, you can make management adjustments to make it better.

As this data is based on the official website information and actual research, the data obtained is relatively accurate, so the results of the hierarchical analysis are more accurate. In addition, in the practical application of the analytic hierarchy process, attention should be paid to the determination of weight and the subjectivity of judgment, as well as the different hierarchy structures and the selection of indicators that may lead to different results. Therefore, when using the analytic hierarchy process, it is necessary to conduct reasonable modeling and data analysis and combine the actual situation to make judgments and decisions.

The result is a good demonstration of BH Air's focus on the aspects, and also an evaluation of the existing service providers to find out their shortcomings, to better manage them.

5 Results Research

This chapter will tell you what happened on a return visit to BH Airlines. Set 2-3 questions to interview the staff and get feedback. Therefore, this chapter mainly introduces the specific interview content, as well as the feedback received, and draws conclusions.

5.1 Interview Contents

One month after the data was obtained, I visited BH Airlines again. Led by the staff, 5 staff members and 3 staff members of logistics service providers were interviewed successively.
The interview of BH Company personnel includes the following parts:
(1) whether the evaluation is accurate;
(2) What shortcomings do you think the evaluation method has?
(3) This method is used to select the convenience provided by the service provider.

The contents of the visit to service providers are as follows:
(1) Whether the evaluation result is accurate
(2) In what areas have you made adjustments?

5.2 Feedback Results

(1) BH Airlines survey results
All five staff members indicated that the results of the evaluation method were accurate and consistent with reality. Three of them mentioned that the method has a certain subjectivity, and subjective judgment will affect the results to some extent. Two of them mentioned that this method needs to establish appropriate indicators, and this process needs to be more rigorous. Different indicators will lead to different conclusions.
In terms of the selection of service providers, they both mentioned that the analytic hierarchy process (AHP) can help BH company quickly select its service providers to improve the efficiency of logistics transportation. Meanwhile, it can also better manage the existing logistics service providers and make it clear which direction to strengthen management.

(2) Survey results of service providers
The three service providers have always believed that the evaluation results are accurate.
The staff of F1, the service provider, said that the transportation efficiency will be optimized to improve the transportation efficiency while ensuring quality. Make every aspect of the service provider the best.

F2 said that they would pay more attention to sustainability. In this way, they also recognized BH Airlines' emphasis on sustainability, so they would also focus on this aspect of adjustment.
The staff of the F3 service provider mentioned that this method helped them find out the existing deficiencies so that they could make targeted optimization and adjustment, and make clear the direction of improvement. Therefore, the F3 service provider adjusted the transportation cost and information technology and paid more attention to this aspect.

5.3 Overall Results

Through this interview, it can be found that this method can help BH Airlines to evaluate and analyze the existing service providers, and at the same time, it can provide great convenience when helping them to choose the right service providers. Therefore, the results of this study are reasonable and can be applied. At the same time, the specific content of this method should be slightly adjusted with changes in future development, to better help BH Airlines management.
At the same time, this method also has certain help to logistics service providers, so that it can develop better. It can also help them conduct internal evaluation research.

6 Summary and Outlook

This chapter summarizes from three aspects, and analyzes the existing shortcomings, in order to improve in the later development, evaluation. At the same time, we forecast that the development of the industry will be better and better in the future, so we can better cope with future changes through the outlook.

6.1 Summary

According to the above analysis, the following conclusions can be drawn
(1) With the continuous development of the aviation industry, aviation logistics is developing rapidly and attracting more and more attention from enterprises. Therefore, effective cooperation between airlines and logistics service providers can greatly improve the efficiency of logistics transportation and improve the level of logistics service. Therefore, airlines need to choose the right and appropriate logistics service providers.
(2) It is necessary to establish a comprehensive evaluation index system for the correct evaluation of logistics service providers. Based on the factors considered by BH Airlines, this paper divides evaluation indexes into five categories: transportation efficiency, transportation cost, service quality, sustainability, and information technology, to establish a comprehensive evaluation index system.
(3) This paper adopts an analytic hierarchy process, which can help BH Airlines pay more attention to the aspects of service providers. Meanwhile, it evaluates the existing three service providers and finally finds that service provider F1 is better than the other two service providers. Meanwhile, through investigation, it can be found that this method provides great convenience for BH Airlines to select the right service provider.

In addition, there are some limitations in this study, including the following:
(1) Limited data sources: The data sources used in this study are mainly the information provided by the enterprise itself and the public data, so there is a possibility of incomplete and inaccurate information. At the same time, all the information about the enterprise cannot be obtained, and there may be some deviations.
(2) Limited number of samples: The number of samples in this study is small, which may not represent the situation of the whole Chongqing area. Meanwhile, there may be some subjectivity and bias in the selection of samples.
(3) Limitations of the model: The Analytic Hierarchy Process (AHP) model adopted in this study is a qualitative and quantitative method. Although it can evaluate and compare multiple factors, it also has some limitations, for example, the judgment of the influence degree between different factors may be subjective and uncertain

6.2 Outlook

In the future, the development of aviation logistics will be better and better. To adapt the evaluation system to the constantly evolving needs of the airline and the changing trend of the logistics industry, the following problems need to be further studied in future work:

(1) Real-time optimization of the evaluation index system of aviation logistics service providers. According to the needs of future development, timely adjust the evaluation requirements, so that the requirements are more in line with the development of the company, and can timely adjust and plan the service providers

(2) Accumulation of appraisal data and expansion of source channels.

In the later accumulation, we can collect some information about other companies, not only limited to a single company. Meanwhile, we can further expand the source channels, not only through the official website and field survey but also by issuing questionnaires to collect public opinions.

(3) Further improvement of the comprehensive evaluation method

In the subsequent evaluation, the analytic hierarchy process and fuzzy comprehensive evaluation can be combined to make the result more accurate. The fuzzy comprehensive evaluation method can transform qualitative evaluation into quantitative evaluation, make the result more clear and more systematic, and can better solve fuzzy and difficult-to-quantify problems.

It is a complex project to establish a set of scientific and reasonable evaluation standards and methods for air logistics service providers. In the future, it is believed that the research on this aspect can be more abundant, reduce the limitations and one-sidedness, and help them better development of air logistics.

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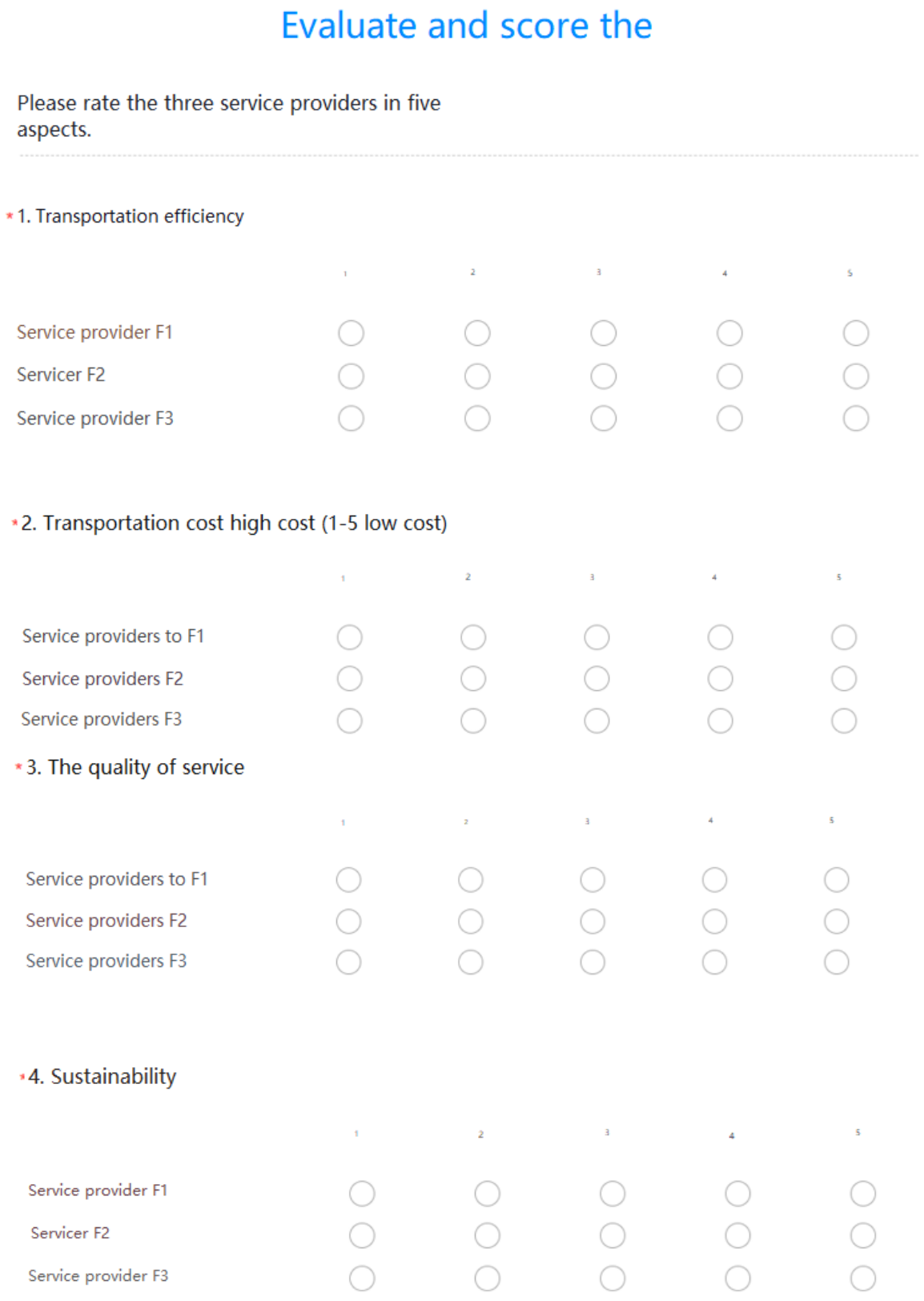
Appendix

First establish the questionnaire, as shown in the figure below:

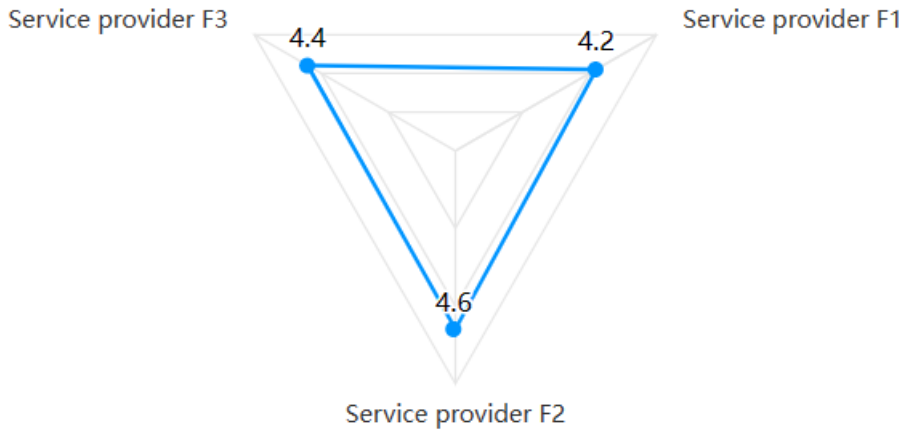


* 5. Information technology

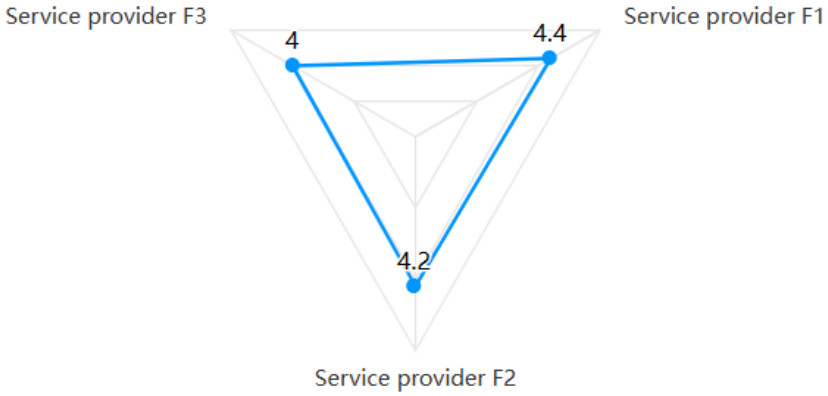
	1	2	3	4	5
Service provider F1	○	○	○	○	○
Servicer F2	○	○	○	○	○
Service provider F3	○	○	○	○	○

The average of each term is shown in the figure below:

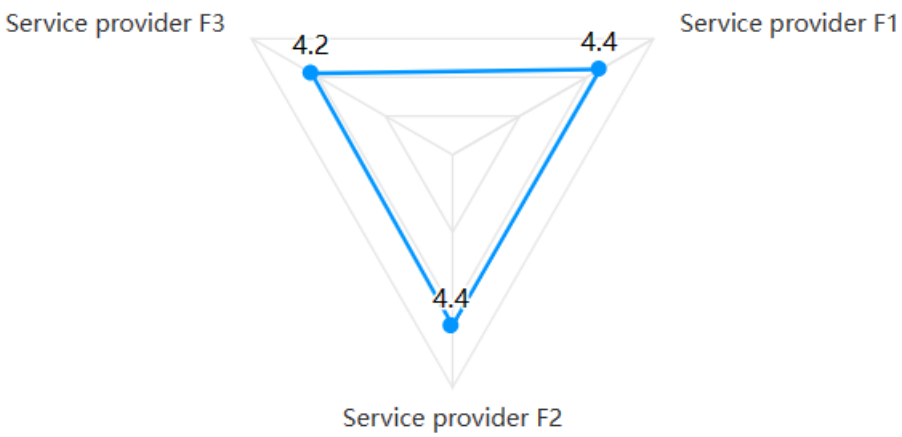
A. Transportation efficiency:



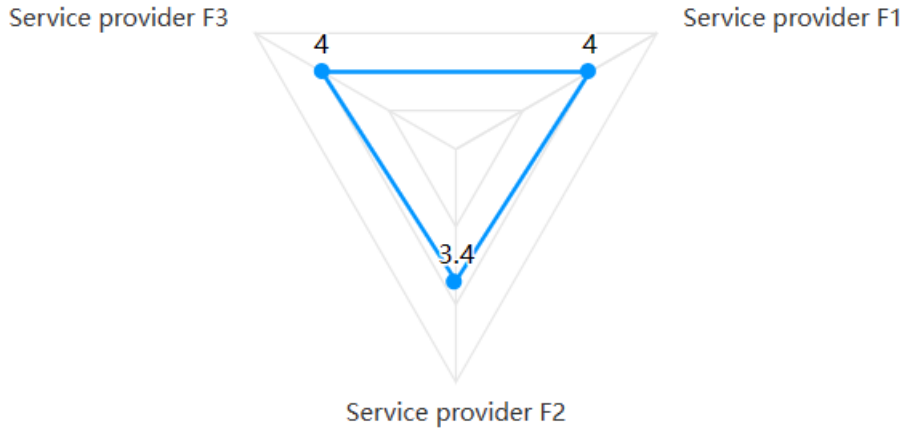
B. Transportation cost:



C. Service quality



D. Sustainbility



E. Information technology