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Article

Supplier performance assessment: Empirical evidence in Indonesian freight forwarding companies

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Abstract: This research aimed to assess the results of two vendors used by the company in the shipping process of export goods. Two leading suppliers for one similar activity had caused more difficulties in the monitoring and controlling activities of DHL Global Forwarding Indonesia. This research used qualitative and quantitative methods, with the Analytic Hierarchy Process decision-making method using 36 internal staff members as the sample. Through a qualitative calculation method by distributing questionnaires to the existing suppliers, namely Monang Sianipar Kargo and Andima Transportindo, it was found that the weighted score for Monang Sianipar Kargo was 22.84 and for Andima Transportindo was 10.66. Subcriteria and indicators should be prioritized in the criteria of Price and service, significantly to improve the performance of problematic suppliers. This research recommended using the Analytic Hierarchy Process for assessment since it facilitated the research development by the opinion of the company's experts. Such a finding implied that a policy from the management was needed in the assessment of suppliers. As an implication, it was necessary to assess all suppliers cooperating with DHL Global Forwarding Indonesia by using actual data from the current month.

Keywords: export cargo delivery; performance assessment; freight forwarding company; priority suppliers

1. Introduction

DHL Global Forwarding is a multinational company that runs a freight forwarding service in Indonesia that is closely related to the daily activities of inter-country export-import delivery. It has been widespread for consumer satisfaction to be the main priority. The corporate culture orientated to customer satisfaction is undeniable in DHL Global Forwarding. More specifically, as a case study for this research, this company has an air export-import division related to speed and timeliness. The customers who decide to send airfreight expect that their cargo, trusted by the company, will be delivered to the destination on time (Ricardianto et al., 2023a).

Some suppliers in its business operations support DHL Global Forwarding. This is not separated from the company's efforts to maintain its business effectiveness and efficiency while maintaining control that all company service activities are by the company's global standards. Seeing the use of suppliers in some company activities, the authors find a phenomenon in which the company uses two different suppliers to do the same job activities, especially in the export airfreight division (Rizaldy et al.,

2024). This phenomenon has driven the authors to further research concerning the criteria and sub-criteria used by DHL Global Forwarding in selecting the suppliers and the result of the existing supplier assessment based on its criteria and sub-criteria.

Using two suppliers for the same activities in a company can make monitoring and controlling activities more difficult since both suppliers show different performances of output and input. Based on the company's data, the two suppliers have different amounts of invoices and achievement of Key Performance Indicators, although both of them are burdened with the same job activities. This motivates such research related to the assessment of the available criteria, subcriteria, and the implementation of the evaluation of the two existing suppliers. The problem is that, until now, the assessment result based on the four existing criteria has yet to be known since one criterion over another is considered superior in supplier selection. A consistency test needs to be conducted against some suppliers in the export airfreight division of DHL Global Forwarding Indonesia based on the four criteria and their sub-criteria. The priority suppliers are based on the existing criteria and sub-criteria.

Several types of research related to freight forwarding companies have described the phenomenon that has been studied before. A freight forwarder is generally a company that obtains orders to deliver a significant quantity from the manufacturers or producers to the market or the ultimate points of distribution (Barata et al., 2024; Gupta et al., 2023; Pradeep, 2023). An expedition company also acts as a travel agent for the cargo industry or the third party that provides logistics. Many freight forwarding companies create tighter competition among service providers and play an essential role in helping export-import activities (Ouyang and Bu, 2024; Rahmasari et al., 2024). Freight forwarding companies maintain their existing customers to avoid a loss of customers because a customer is crucial in the continuity of such a delivery service business.

The optimization of various dimensions of export activities supports freight forwarding companies in improving their export performance (Purwaningsih et al., 2024; Shojaei et al., 2021). An expedition company must meet the deadline and provide a reliable schedule for export cargo supply to fulfill their obligation to their customers (Parimala, 2013). No less important is that written communication is needed to reduce miscommunication due to different languages and different work hours, which can also cause problems (Lovanda et al., 2023). Finally, Aini et al. (2022) show that the role of freight forwarding companies in cargo delivery is influenced by the prevailing legislation in Indonesia and is considered capable of strengthening the obstacle factors in the cargo delivery process.

This research uses the Analytic Hierarchy Process (AHP) method to determine choices. Some essential criteria and sub-criteria are selected based on the literature and evaluated to select the suppliers using AHP (Güldeş et al., 2022; Santoso and Besral, 2018). AHP is indispensable in operations management to identify the decision areas with better research gaps (Subramanian and Ramanathan, 2012). Another finding shows that many AHP implementations are conducted when the problems need quantitative and qualitative considerations. In transportation and logistics, the AHP method has been studied before, especially its implementation by freight forwarders (Alvarez et al., 2023; Bulut and Duru, 2018; Dožić et al., 2023; Mizrak and Akkartal, 2023; Moslem et al., 2023; Zaid et al., 2024). Specifically, freight forwarders have

also implemented multicriteria-based decision-making for selecting suppliers using fuzzy AHP (Deretarla et al., 2023; Yadav and Sharma, 2016a; Yang et al., 2010).

The gaps in this research are related to some aspects, such as empirical and methodological gaps. Different results are found in some previous relevant research related to the variables studied. In general, the analysis of supplier performance assessment still needs to be improved because it does not include the supplier perspective, especially the leading performance indicators they consider relevant and in line with their objectives. In the research by Romule et al. (2020), in the UK, out of ten criteria set up, only some categories are considered high, namely: net profit, flexibility, responsiveness, delivery performance, and cycle time, the quality-adjusted to financial category, and internal business process. Not all criteria in that research can be successfully adjusted by the supplier. The study by Zoghi et al. (2024) explains that supplier assessment using a benchmark is not determined independently. Still, interdependent output data for two consecutive years covering 32 suppliers should be considered sustainably.

Other research by Burkhart and Bode (2024) and Chen et al. (2019) state it is essential to note that the supplier of important components with many experiences is unlikely to be terminated by the producer rather than the supplier with low performance. If the experienced supplier makes some mistakes, that supplier's contract may also be terminated. The use of some methods, such as AHP and FMEA, for supplier assessment with the risk of failure shows that the reliability of the FMEA model will provide a risk value and rating (You and Song, 2024). In the different use of supplier selection methods, Hosseini et al. (2022) use sensitivity analysis to analyze the influence of quantity discount, uncertainty of supply, and supplier demand. Concerning the use of two suppliers, it is only sometimes the main choice, and retailers will select one high-quality supplier if it is more profitable rather than using two suppliers at the same time. Some supplier selection methods to choose the best environment-friendly supplier have been implemented by integrating the processes of AHP, TOPSIS, and Fuzzy AHP Pythagoras with the interval value to obtain ratings and decide the most appropriate supplier (Çalık, 2021; Ecer, 2022; Hajiaghaei-Keshteli et al., 2023).

In the gap of previous research, there are different opinions related to supplier selection. Some gaps can be seen from the selection of main performance indicators, the categories rated high, which are only a few, the necessity of collecting data in time series, and the use of two suppliers at the same time. Methodological gaps exist in the different uses of AHP, TOPSIS, Fuzzy AHP, and sensitivity analysis.

As described before, this research has identified the essence of analyzing the supplier performance assessment in the export airfreight division of DHL Global Forwarding Indonesia using the AHP method. This research has several main problems; the essence is to measure the four criteria for assessing a supplier in the export airfreight division of DHL Global Forwarding Indonesia: price, service, quality, and reliability. The other problems are what is the result of consistency level testing based on respondent's assessment of the criteria and their sub-criteria, and what is the result of priority supplier based on the supplier's assessment of the export airfreight division of DHL Global Forwarding Indonesia by using the Analytic Hierarchy Process method.

The problem is that until now, the assessment result based on the four existing criteria has yet to be known since one criterion over another is considered superior in supplier selection. A consistency test needs to be conducted based on the four criteria and the sub-criteria of some suppliers in the export airfreight division of DHL Global Forwarding Indonesia. The priority suppliers are based on the existing criteria and sub-criteria.

This study aims to know the results of assessments on two priority vendors used by the company in the shipping process of export goods. Global Forwarding Indonesia uses the AHP method to determine the outcome of the consistency level test based on the respondents' judgment of the criteria and sub-criteria in the DHL Global Forwarding Indonesia export airfreight division. This research finds the necessity of information on the most optimal supplier providing services for the company, namely Andima Transportindo and Monang Sianipar Kargo, which are assigned in the process of export handling. Based on the company's data, both suppliers have different values of accounts receivable and other achievements in key performance indicators. However, both of them are assigned to the same jobs.

This encourages the researchers to review the existing criteria and sub-criteria as well as the implementation of assessment to the existing two suppliers. It has been long enough that some supplier selections have led to the development of an effective, integrated, and dynamic performance measurement system (Yadav and Sagar, 2013). Now, the export airfreight division of DHL Global Forwarding Indonesia has two suppliers handling the export in the field, namely Andima Transportindo and Monang Sianipar Kargo.

2. Literature review

2.1. Supplier performance assessment

Suppliers are an essential part of the business since they are supplying products or services at the best quality and Price to another party or producer to do their business so that distributors also get profits while distributing to the end consumers (Saribanon et al., 2023; Tang et al., 2001). It is highly expected that trusted suppliers, which are selected based on the opinion of Han et al. (2017), will determine the planning and controlling supply aimed at reducing the cost of supply. According to Liu et al. (2017) and Siagian et al. (2022), suppliers can help organizations benefit from an increasingly competitive global environment and have sufficient technical knowledge, specific skills, and experienced suppliers. Finally, the collaboration and integration between suppliers and customers will be able to save the cost of sales and profit margin to improve their production and performance (Ardakani et al., 2023; Farisyi et al., 2024; Mandagie et al., 2024; Silva et al., 2024). Assessment is made by comparing the target and the job requirements in the form of job standards that have been established during a specific period. The supplier is the source that provides the first material. When the chain of cargo distribution starts, this first material can be in the form of raw material, auxiliary material, merchandise, sub-assemblies, and spare parts.

Stevenson (2002) explains some criteria for selecting a supplier consisting of six categories such as (1) price, (2) quality, (3) service, (4) location, (5) supplier policy fulfillment, and (6) flexibility. Kotler and Keller (2016) propose that Price is the

amount of money charged for a product or service or the sum of value consumers exchange for the benefits of having or using the product or service. According to Kotler (2018), price is one of the elements of the marketing mix that generates revenue. Price is the most straightforward element to adjust in the marketing program, compared with product features, channels, and communication, which need more time. A price is a monetary unit, or another measurement unit (including other goods and services) exchanged to obtain the ownership right or user right over an item or service.

2.2. Service quality

Theoretically, quality directly contributes to service performance (Kotler and Armstrong, 2018). Service quality is the attitude of a producer to fulfill customer needs. Service quality is an important variable that enhances customer satisfaction and trust (Angelova and Zekiri, 2011; Ricardianto et al., 2023b; Widiyanto et al., 2021). According to Zeithaml and Bitner (2011), the service quality theory concerns expectation and relies on the gaps among passengers using the dimensions of guarantee, empathy, reliability, response, and tangible. Transportation service quality is theoretically defined as a series of features that become the characteristics of certain transportation services related to the needs and expectations of transportation users (Markowska, 2020; Rahmanita et al., 2023). Specifically in cargo delivery, some operational dimensions of the Service Quality variable are recently much needed to evaluate service quality (Aldatmaz et al., 2021; Saini and Singh, 2018). Finally, the ability of logistic service providers to provide the best service quality is essential for improving service performance (Roslan et al., 2015). According to Kolat et al. (2019), service quality is a business of what customers expect and how far their expectations are fulfilled.

2.3. Analytic hierarchy process (AHP)

This research uses the Analytic Hierarchy Process (AHP) method, and the framework is described in the conceptual model (**Figure 1**). AHP is a standard method and is generally used as a problem-solving method in selecting the best supplier based on the predetermined criteria and sub-criteria. Theoretically, AHP is the most appropriate system to make decisions with many criteria because it enables formulating problems in a hierarchy and relies on a mixture of quantitative and qualitative criteria (Saaty, 1984, 2012; Taherdoost, 2017). AHP is a decision-making method developed to give priority to several alternatives when some criteria must be taken into consideration and permit the decision-maker to formulate complicated problems into a hierarchy or an integrated series of levels (Bulut and Duru, 2018; Santoso and Besral, 2018; Vaidya and Kumar, 2006). This is an ideal method to rank some criteria and sub-criteria in the decision-making. The AHP method is suitable for this research because it is relatively easy to understand and implement. Especially for supplier selection, there have been many researches using sensitivity analysis based on the weight of AHP to effectively select the appropriate suppliers (Chen, 2020). Concerning AHP proposed by other researchers (Krajnc and Glavič, 2005) explain that using indicators related to a company's sustainable development is essential in decision-making because it is tough to evaluate a company's performance based on too many indicators. They explain that using indicators limited to the AHP method is

highly prioritized when setting up the criteria and sub-criteria.

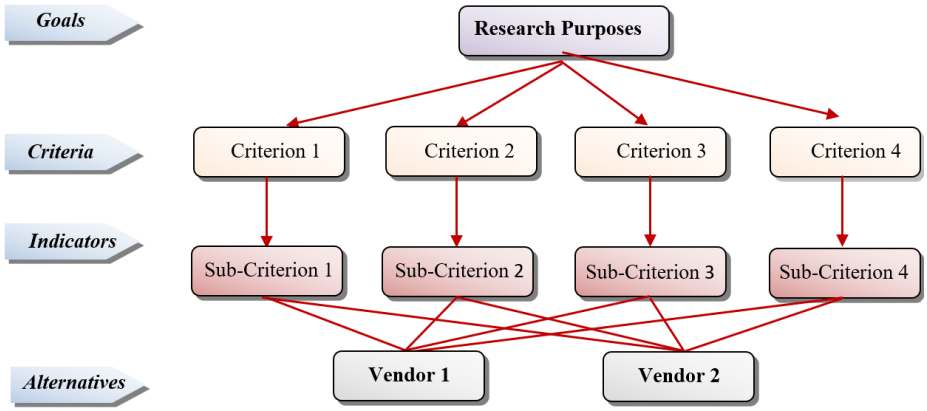

Figure 1. Model of the hierarchy structure of AHP method.

Source: Researcher's data.

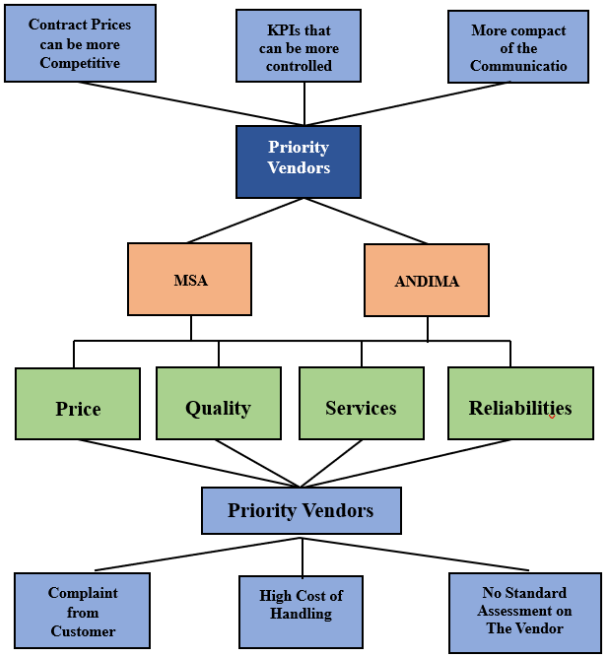

Figure 2. Conceptual method.

Source: Researcher's data.

Several vital criteria and sub-criteria are generally chosen based on the literature and have been evaluated to select suppliers using AHP. Boujelbene and Derbel (2015), Güldeş et al. (2022), Peng (2012), and Santoso and Besral (2018) have developed evaluation criteria to compare different operators by using a multicriteria-based decision method using the AHP method with the quality of services as a criterion. Further research by Dožić et al. (2018), Maier et al. (2020), and Peng (2012) use the AHP method with Price and cost as criteria. Other research uses AHP criteria, such as service based on experience, contract, commercial, and manufacture. Many studies use the AHP method with the requirements of price and service quality (Gergin et al., 2022; Khoshfetrat et al., 2020). Thus, based on several literature reviews related to service quality and supplier performance assessment as well as their definitions, the assessment using the AHP method is much needed to support and analyze the decision

process of supplier selection in the DHL Global Forwarding Indonesia.

Based on those four criteria, the conceptual method can be described in **Figure 2**.

3. Research method

This research uses qualitative and quantitative methods, including the Analytic Hierarchy Process (AHP) decision-making method. This method is commonly used as a problem-solving method to select the best supplier according to the criteria and sub-criteria. Concerning the research variables, DHL Global Forwarding Indonesia has four indicators as the reference in the supplier performance assessment. The four indicators are Price, quality, services, and reliability, with the elements of responsibility and flexibility integrated into the service. This research is related to the selection of research dimensions, the determination of criteria up to the placement of sub-criteria, which become the assessment indicators in the supplier selection and are categorized as a qualitative research method. AHP method is implemented in several steps, namely (1) defining the problems and determining the expected solutions, (2) making a hierarchical structure, (3) making a pairwise comparison matrix, (4) defining pairwise comparison, (5) calculating the eigenvalue and testing its consistency, (6) calculating the eigenvector of each pairwise comparison matrix, and (7) checking the hierarchical consistency. Concerning research variables, DHL Global Forwarding Indonesia has criteria and sub-criteria for assessing DHL suppliers.

Global Forwarding Indonesia (**Figure 1**) includes (1) criterion 1: price, having sub-criterion of fair Price suitable with the service as well as offering price discount; (2) criterion 2: quality, having sub-criterion of service compatibility with technical specifications, how to anticipate work accident and consistently deliver good service quality, (3) criterion 3: service, having sub-criterion of accessible communication, quick response to the assignment giver and ability to deliver information firmly and clearly, and (4) criterion 4: reliability, having sub-criterion of timeliness in the cargo delivery and problem-solving that can be handled appropriately and quickly. This research has the primary data for assessing two suppliers of DHL Global Forwarding Indonesia, as well as MSA Kargo and Andima Transportindo, as the objects of research in the export cargo delivery division. Then, the samples of this research are those having the authority to make decisions in the supplier assessment, namely the Head of Airfreight Department, Head of the CDZ Department, Chief Financial Officer, and some representative managers such as export and import manager, managers of supplier management, as well as procurement supervisors, purchasing staff and export operation staff.

The research used in-depth interviews with DHL Global Forwarding Indonesia employees, with 36 respondents as the sample and ten experts helping with the supplier assessment. Two suppliers, namely Monang Sianipar Cargo and Andima, are included in the 36 samples. They must answer the questions the assessor team asks after they finish each phase of work. Interviews are conducted with source persons selected by the researcher who is regarded as directly related to and responsible for the process of supplier's activities in the export airfreight division of DHL Global Forwarding Indonesia. This is carried out to ensure the validity of the obtained data of supplier performance assessment in the form of Key Performance Indicators and the

invoice payment to the two vendors in the period of the last two consecutive years. The researchers also found other documents such as the company profile, organization chart, business process, and other quantitative data.

The data analysis technique of AHP calculates the eigen vector of each pairwise comparison matrix. The steps of calculation are carried out by adding up the values of each column of the matrix, dividing each value of the column with the value of all columns to get matrix normalization, and adding up the values of each row and dividing it with the number of elements to get the average. Consistency becomes the main priority in AHP (Ergu et al., 2011).

The data analysis in this research uses Moderated Regression Analysis with some formulas, namely λ max, Consistency Index (CI), Consistency Ratio (CR), and Random Consistency Index (RI) (Saaty, 1998). The structural equation model in this research is as follows:

$$\lambda\text{max} = \sum\lambda/n \quad (1)$$

$$\text{CI} = (\lambda\text{max} - n)/(n-1) \quad (2)$$

$$\text{CR} = \text{CI}/\text{IR} \quad (3)$$

where: λmax = constant, n = number of elements (matrix ordo), CI = Consistency Index (See **Table 1**), CR = Consistency Ratio, IR = Random Consistency Index.

Table 1. Consistency comparison scale.

Matrix size	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
RI Value	0.00	0.00	0.58	1.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51	1.48	1.56	1.57	1.59

Source: Saaty (1998).

When checking the hierarchy of consistency, if the value is more than 10%, the data judgment must be improved. However, if the Consistency Ratio (CI/IR) is less than or equal to 0.1, then the calculation result is regarded as correct (Saaty, 1998). To validate the priority vector of AHP against the measurement using the known scale. The measurement must be normalized first by dividing it by the number of priority vectors (Whitaker, 2007).

4. Results and discussion

4.1. Results of validity and reliability tests

The result of the validity test proves that the questionnaire for the criteria of Price, quality, service, and reliability are valid, with the value of Pearson Correlation being 0.804 and above the limit of 0.05 from each sub-criterion. Considering the reliability test result, if the reliability statistics are on the value of Cronbach's alpha and above the limit of 0.06, the sub-criterion is regarded as reliable. This research finds the reliability statistics of the price criteria 0.395, the quality criteria 0.791, the services criteria 0.511, and the reliability criteria 0.816. This means the Price, quality, service, and reliability requirements are reliable.

4.2. Supplier assessment criteria

Based on Questionnaire I, on average, respondents say that the criteria and sub-criteria listed in the questionnaire are critical for supplier assessment (**Table 2**). In

determining the importance of supplier assessment in each criterion, the result of respondents' judgment is obtained between 3.2–3.6 and 3.4 on average, meaning that all the requirements are critical and included in the pairwise matrix. The respondents are 36 DHL Global Forwarding Indonesia employees, especially from the export airfreight division, including ten experts. In-depth interviews with them have been conducted this month.

Table 2. Calculation of determining the importance of supplier assessment for each criterion (questionnaire i).

Criteria and Sub-Criteria	Average	Total
Price		
Suitability and appropriateness of prices for the services provided	3.4	34
Ability to provide discounts	3.3	33
Quality		
Conformity of services provided with Key Performance Indicators	3.4	34
Ability to anticipate work accidents	3.2	32
Ability to provide discounts	3.4	34
Services		
Ease of communication access	3.2	32
Speed in providing responses	3.3	33
Ability to present information that is clear and easy to understand	3.2	32
Reliability		
Ability to deliver goods according to time and place	3.5	35
Ability to handle problems in the field	3.6	36

Source: Researcher's data.

4.2.1. The results of analysis of expert response to the criteria of priority supplier

The results of Questionnaires II–IV are shown in the pairwise comparison matrix, and their weight of score and consistency are analyzed (**Table 3**).

Table 3. Normalization of priority suppliers assessment criteria (questionnaire ii–iv).

	Normalization of priority suppliers assessment criteria							
Criteria	**Price**	**Capacity**	**Services**	**Time**	**Total**	**Priority factor**	**Matrix X factor**	**Consistency**
Price	0.25	0.23	0.36	0.32	1.17	**0.29**	1.02	3.49
Quantity	0.21	0.30	0.34	0.10	0.94	0.23	1.02	4.34
Services	0.37	0.40	0.25	0.10	1.13	0.28	1.02	3.63
Time	0.17	0.07	0.05	0.48	0.76	0.19	1.02	5.35

Source: Researcher's data.

The hierarchical level in **Table 3** is consistent with the Critical Ratio (CR) under 10%, and the price criterion has a priority factor as significant as 0.29 percent. Based on the normalization of priority supplier assessment criteria by calculating the criteria from Saaty (1998), it is obtained that λ max 4.20, Consistency Index (CI) 0.07, Random Index (RI) 0.90 resulting in the score of Consistency Ratio (CR) for Price as

big as 0.07, still less than 0.10, meaning that they are consistent and fulfilled. Thus, the four criteria for Questionnaire II–IV have been normalized.

4.2.2. The result of analysis of expert response to the price

The hierarchical level in **Table 4** is consistent with the pairwise matrix in the sub-criteria of price criteria with CR under 10 percent. Based on the normalization of priority supplier assessment criteria by calculating the criteria from Saaty (1998), especially the requirements for Price, obtained the λ max 1.76, Consistency Index (CI) −0.24, Random Index (RI) 0.00, resulting in the score of Consistency Ratio (CR) for Price as big as 0.00, still less than 0.10, meaning that they are consistent and fulfilled. Thus, the criteria for Price have been normalized.

Table 4. Normalization on the tabulation of priority suppliers assessment criteria.

	Normalization					
	Price 1	**Price 2**	**Total**	**Priority Factor**	**Matrix X Factor**	**Consistency**
Price 1	0.57	0.43	1.00	0.50	0.88	1.76
Price 2	0.43	0.57	1.00	0.50	0.88	1.76

Source: Researcher's data.

4.2.3. The result of analysis of expert response to the quality

The hierarchical level in **Table 5** is consistent with the pairwise matrix in the quality criteria, with CR consistently under 10%. In the sub-criteria for Quantity 3, the ability to provide services, the highest priority factor, is 0.47. Based on the normalization of priority supplier assessment criteria by calculating the criteria from Saaty (1998), especially the requirements for Quantity 3 it is obtained the λ max 3.06, Consistency Index (CI) −0.03, Random Index (RI) 0.58 resulting in the score of Consistency Ratio (CR) for Quantity 3 as big as 0.06, still less than 0.10, meaning that they are consistent dan fulfilled. Thus, the criteria for Quantity 3 have been normalized.

Table 5. Normalization of priority suppliers assessment criteria.

	Normalization						
	Quantity1	**Quantity 2**	**Quantity 3**	**Total**	**Priority Factor**	**Matrix X Factor**	**Consistency**
Quantity 1	0.39	0.06	0.29	0.74	0.25	0.95	3.84
Quantity 2	0.09	0.29	0.49	0.86	0.29	0.95	3.31
Quantity 3	0.53	0.65	0.21	1.40	**0.47**	0.95	2.04

Source: Researcher's data.

4.2.4. The result of analysis of expert response to the services

The hierarchical level in **Table 6** is consistent with the pairwise matrix in the quality criteria, with CR consistently under 10%. In the sub-criteria for Services 2, the highest priority factor for giving a quick response is 0.39. Based on the normalization of priority supplier assessment criteria by calculating the criteria from Saaty (1998), especially the criteria for Services 2, it is obtained the λ max 3.07, Consistency Index (CI) 0.03, Random Index (RI) 0.58, resulting in the score of Consistency Ratio (CR) for Services 2 as big as 0.06, still less than 0.10, meaning that they are consistent and fulfilled. Thus, the criteria for Services 2 have been normalized.

Table 6. Normalization of priority suppliers assessment criteria.

	Normalization						
	Services 1	**Services 2**	**Services 3**	**Total**	**Priority Factor**	**Matrix X Factor**	**Consistency**
Services 1	0.36	0.51	0.14	1.01	0.34	1.00	2.99
Services 2	0.55	0.33	0.29	1.17	**0.39**	1.00	2.57
Services 3	0.09	0.16	0.58	0.83	0.28	1.00	3.64

Source: Researcher's data.

4.2.5. The result of expert response concerning reliability

The hierarchical level is consistent with a pairwise matrix on the sub-criteria of time under 10% (**Table 7**). Based on the normalization of priority supplier assessment criteria by calculating the criteria from Saaty (1998), especially the criteria for Reliability 1 and Reliability 2 it is obtained the λ max 1.76, Consistency Index (CI) −0.24, Random Index (RI) 0.00 which result in the score of Consistency Ratio (CR) for Reliability 1 and Reliability 2 as big as 0.00, still less than 0.10, meaning that they are consistent and fulfilled. Thus, the criteria for Reliability 1 and Reliability 2 have been normalized.

Table 7. Normalization on the tabulation of priority suppliers assessment criteria.

	Normalization					
	Reliability 1	**Reliability 2**	**Total**	**Priority Factor**	**Matrix X Factor**	**Consistency**
Reliability 1	0.51	0.49	1.00	0.50	0.88	1.76
Reliability 2	0.49	0.51	1.00	0.50	0.88	1.76

Source: Researcher's data.

4.3. Resulted in calculation of the partial weight of criteria and sub-criteria

Table 8, with ten sub-criteria, is based on **Table 1** and is the recapitulation of partial weight coefficients based on the results of Questionnaire II–IV in **Table 4** up to **Table 7** for the score of priority factor and the sub-criteria of each Indicator. According to the calculation of all criteria in **Table 4** up to **Table 7** with the same calculation and formula as those from Saaty (1998), namely λ max, Consistency Index (CI), and Consistency Ratio (CR), which are still less than 0.10, it can be concluded that they are consistent and normalization of all criteria and sub-criteria have been fulfilled and validated.

The analyzed price criterion has the most significant partial weight, 0.29, ranging from 0.25 to 0.5 (**Table 8**). This means that the price criterion is the main factor prioritized by the company, as well as the other three criteria, namely service, capacity, and time. Its maximum score is 27.33, and its minimum score is 3.20; its Score Range (Max-Min) is 24.00, whereas the Score of Each Interval (Range/n) is 6.00. At the end of this research, the suppliers' score can be classified as follows: interval 1 with a range of 3.20–9.20 is poor, interval 2 with a range of 9.21–15.21 fairly good, interval 3 with a range of 15.22–21.22 is good, whereas interval four ranging from 21.33 to 27.33 is perfect. So, in the final result of the supplier assessment, the score of MSA Kargo is 22.84, classified as very good, and Andima Transportindo's score is 10.66,

classified as good (**Table 9**).

Table 8. Recapitulation of partial weight calculations for each indicator.

Criterion	Priority Factor	Sub-Criteria	Partial Weight
Price	0.29	Fair and suitable Price	0.50
		Offering price discount	0.50
Quality	0.23	Service conformity with technical specifications	0.25
		How to anticipate work accidents	0.29
		Consistently provide good service quality	0.47
Services	0.28	Communicate easily	0.34
		Quick response to the assignment giver	0.39
		Able to deliver information firmly and clearly	0.28
Reliability	0.19	Timeliness in the cargo delivery	0.50
		Problems can be solved appropriately and quickly	0.50

Source: Researcher's data.

Table 9. Data of vendor research with the indicator/sub-criteria as measuring tool.

Sub-Criterion	Rating		Weight Score	
	MSA	Andima	MSA	Andima
Congeniality and appropriateness of the price for the service provides	0.69	0.31	2.35	1.05
Ability to grant and/or provide discounts	0.66	0.34	2.16	1.14
Conformity of services provided with company specifications	0.69	0.31	2.35	1.05
Ability to anticipate and foresee working accidents	0.57	0.43	1.82	1.38
Ability to maintain high service standards	0.72	0.28	2.46	0.94
Ease and simple of access to communications	0.69	0.31	2.22	0.98
Rapidity of response	0.70	0.30	2.31	0.99
Ability to present clear and easy-to-understand information	0.57	0.43	1.81	1.39
Ability to deliver goods according to time and place	0.77	0.23	2.71	0.79
Ability to handle problems in the field	0.73	0.27	2.63	0.97

Source: Researche's data.

4.4. Discussion

Price, quality, service, and reliability are essential criteria the company monitors. Proportionally, the weight from the sub-criteria of quality is as follows: (1) the compatibility of supplier service with the technical specifications is 0.25, (2) the ability to anticipate work accidents is 0.29, (3) the ability to deliver consistent services is 0.47, and (4) the consistency ratio is 0.06. The weight proportion from the sub-criteria of service consists of (1) the ease to communicate 0.34, (2) the quick response to complaints 0.39, (3) the precise information is 0.28, and (4) the consistency ratio is 0.06. The fourth result was obtained from the questionnaire, as big as 0.19, or 19%. From the analysis, the weight proportion from the sub-criteria of time can be described as follows: (1) the timeliness in cargo delivery is 0.50, (2) the ability to handle problems is 0.50, and (4) the consistency ratio is 0.00.

The theoretical description and analysis using the approach of the multicriteria AHP model, namely service quality, Price, reliability, and time, contribute directly and

much to supplier selection, especially in cargo delivery services. In general, this research supports the studies by Deretarla et al. (2023), Prasad et al. (2017), Yadav and Sharma (2016b), Sarode et al. (2010), and Sevkli et al. (2008), where multicriteria AHP will determine the selection of supplier and can make an assessment with various criteria. This research results align with previous studies (Alkan and Kahraman, 2023; Anindita and Siregar, 2019; Dožić et al., 2018; Mohsen, 2023). The result of this research is also in line with the study by Yagmahan and Yılmaz (2023) using the approach of integrated ranking based on the decision-making of a multicriteria group.

This research is also in line with some previous studies that have developed evaluation criteria to make a comparison between different operators by using a multicriteria-based decision method, which uses the process of AHP with quality of services as a criterion (Boujelbene and Derbel, 2015; Chao et al., 2023; Peng, 2012). This research supports the studies by Maier et al. (2020), Dožić et al. (2018), and Peng (2012) using the method of AHP with Price as a criterion. Other researchers use AHP criteria, such as service, based on experience, contract, commercial, and manufacture. This research is also in line with other studies that use the method of AHP with the criteria of price and service quality (Gergin et al., 2022; Khoshfetrat et al., 2020). This research supports several previous studies on supplier selection using the AHP method (Cabrita and Frade, 2016; Digalwar et al., 2014; Fagundes et al., 2021; Fagundes et al., 2021).

The selection team uses the criteria and sub-criteria taken from relevant literature as the starting point to make a pairwise comparison of the preset requirements and then quantify them by weighing the priorities of criteria, subcriteria, and alternatives. Mainly related to the selection of two suppliers being employed, this research is in line with the study by Sevkli et al. (2008), concluding that supplier one and supplier two have been identified and one supplier as the best.vTen sub-criteria based on the recapitulation of partial weight coefficients are by the same calculation and formula from Saaty (1998), namely λ max, Consistency Index (CI), and Consistency Ratio (CR) have been stated as consistent, and the normalization of all criteria and sub-criteria has been fulfilled and validated. The result of the calculation in this research supports the opinion of Whitaker (2007). Supplier performance assessment using the AHP model approach with multicriteria, such as service quality, Price, reliability, and time, will become the way to determine the best supplier among two or more companies with a consideration that this may become a research novelty, especially for freight forwarder companies in Indonesia.

5. Conclusion

It has been appropriate to use the AHP method with four criteria for supplier assessment, namely Price (29%), quality (23%), service (28%), and reliability (19%). So, by using the Analytic Hierarchy Process method and combining the conclusions from Questionnaire I (at importance level) used as a weight component and Questionnaire IV, a comparison diagram used as a score component, the analysis states that MSA Kargo is the supplier with the highest score 22.84 (very good). In contrast, Andima Transportindo got a score of 10.66 (reasonably good), and it was noted that Andima Transportindo should improve its performance. Based on the assessment of both suppliers, Andima Transportindo, regarded as reasonably good, will be retained

as the working partner of DHL Global Forwarding Indonesia. The criteria of Price and service must be prioritized in their sub-criteria or indicators, especially for improving the performance of problematic suppliers. This research recommends using AHP for assessment because it makes it easier to develop the research according to the opinion of the company's experts. Exemplary work commitment from each department is needed and prioritized in the assessment. The findings imply that management policy is required for the supplier assessment. As a practical implication, organizing an actual assessment for all suppliers who collaborate with DHL Global Forwarding Indonesia using data from the recent month is necessary.

The limitation of this research is that it focuses only on two existing active vendors in the cargo handling activities of the export airfreight division of DHL Global Forwarding Indonesia, namely MSA Kargo and Andima Transportindo. Another limitation is that the AHP method must be equipped with sensitivity analysis, where decisions can be made based on additional information so that the decision-makers can change their judgment. Testing is conducted through a simulation of increasing or decreasing the weight of criteria by 10% with the consideration that the result is valid. Alternatively, further research reveals that supplier selection needs many more alternative suppliers with equal qualities based on multiple criteria, such as Price, quality, service, and reliability. It also needs to add a sensitivity analysis to make the result of the AHP method more accurate. The criteria regarded as the most important today are Price and services. So, it is necessary to prioritize the indicators for which the problematic suppliers should improve.

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