

Unlocking Efficiency: A Holistic Examination of Freight Forwarder Evaluation through Analytical Hierarchy Process (AHP) at PT XYZ

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Article Information	Abstract
Article History: Received: September 2023 Accepted: March 2024 Published: March 2024	This study undertakes an evaluation of five freight forwarders in PT XYZ with the objective of mitigating customer complaints pertaining to delivery delays, incorrect deliveries, and damaged goods during transit. Employing the Vendor Performance Indicator (VPI) criteria framework, comprising quality, cost, delivery, flexibility, and responsiveness, alongside the Analytical Hierarchy Process (AHP) method, data was collected through questionnaires distributed to three stakeholders within the customs and transportation department. The analysis identifies responsiveness as the most critical criterion, followed by delivery accuracy and cost considerations. Within these criteria, the ability to respond to customer demands, accuracy of material delivery, and shipping costs are delineated as the most influential sub-criteria. Forwarder MD is identified as the top performer, with forwarder CV and forwarder BI following closely. The findings reveal that forwarder MD emerges as the optimal long-term partner for PT XYZ. These findings offer actionable insights and a clear recommendation for PT XYZ or other companies facing similar challenges in selecting the most suitable freight forwarder thus can empower them to make strategic decisions, ultimately driving improvements in service delivery, customer satisfaction, and operational effectiveness on their business.
Keywords: AHP, Freight Forwarder Evaluation, Vendor Performance Indicator.	
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INTRODUCTION

Globalization is a term that refers to the increasing relationships and interdependence between countries and between world communities in many ways, one of which is through international trade. Buying and selling efforts are called export-import transactions in international trade. Typically, entrepreneurs receive support from business entities whose purpose is to offer management services for all the necessary tasks involved in export-import operations. These activities include organizing shipping, transportation, and the receipt of goods using multimodal transport, encompassing land, sea, and air transportation. These business entities are commonly known as Freight Forwarders (Sakti & Ikhsan, 2022).

PT XYZ operates as a prominent manufacturing entity within the electricity sector. In facilitating its operational endeavors, PT XYZ relies on the services of freight forwarders, categorized according to destination routes and cargo specifications. Despite the array of advantages accrued through the engagement of freight forwarder services in the export-import framework, the company has

encountered persistent grievances from clientele pertaining to the performance of these service providers. Noteworthy complaints include:

Table 1: Percentage of Customer Complaints

Customer Complannits	2020	2021	2022
Goods delay	20%	10%	10%
Wrong delivery	20%	10%	10%
Goods damaged on delivery	20%	10%	10%

Source: Processed data (2023)

In 2020, there was a notable escalation in customer grievances encompassing delays in product delivery, incorrect shipments, and goods damaged during transit, peaking at 20%. This figure saw a subsequent decline of 10% in 2021. In response, PT XYZ instituted a regimen of regular short-interval meetings to oversee team performance. The company's acceptable threshold for customer complaints stands at 10%. Despite ongoing utilization of this strategy, the incidence of complaints pertaining to these aforementioned issues has persisted at the threshold level over the past two years. Consequently, PT XYZ recognizes the imperative to explore alternative methodologies to address these concerns, thereby safeguarding customer satisfaction levels. Any deterioration in customer satisfaction is anticipated to correlate directly with diminished customer loyalty, with potential ramifications for the company's revenue stream over the long term.

Hence, it is imperative to conduct a structured and systematic evaluation of the current freight forwarder services utilized, aiming to mitigate the escalation in customer complaints. Employing the Analytical Hierarchy Process (AHP) methodology is deemed essential to generate a comprehensive ranking of freight forwarder services, facilitating informed decisions regarding contract extensions with these service providers by PT XYZ.

This research aims to assess the efficacy of freight forwarder services at PT XYZ through the application of the AHP methodology. Anticipated benefits of this study include practical insights that can inform decision-making processes within companies, aiding in the evaluation of freight forwarders by incorporating criteria established through the AHP methodology. Furthermore, this research aims to contribute theoretically by providing valuable information and serving as a reference point for future investigations exploring the application of the AHP method in the evaluation of freight forwarders.

RESEARCH METHOD

This study adopts a qualitative research methodology, utilizing interviews to gather insights into the challenges and criteria involved in assessing freight forwarders at PT XYZ. Additionally, questionnaires were distributed to three pivotal figures within PT XYZ: a leader in customs and transportation, a transportation coordinator, and a transportation and customs officer. Employing pairwise comparisons, the measurement scale is complemented by the utilization of the vendor performance indicator (VPI) to evaluate criteria effectively.

Table 2: VPI Criteria and Sub Criteria

VPI Criteria	Sub Criteria
Quality	Fulfilled delivery specifications
	Warranty of delivered materials
Cost	Shipping cost
	Payment grace period
Delivery	Accuracy of material delivery
	Accuracy of material pick-up
Flexibility	Ability to fulfil changes in delivery quantities
	Ability to fulfil change in delivery time
Responsiveness	Availability of information systems
	Ability to respond to customer demands

Source: Processed data (2023)

The analytical hierarchy process (AHP) is applied for data analysis, with Microsoft Excel utilized for data processing. The research protocol unfolds as follows:

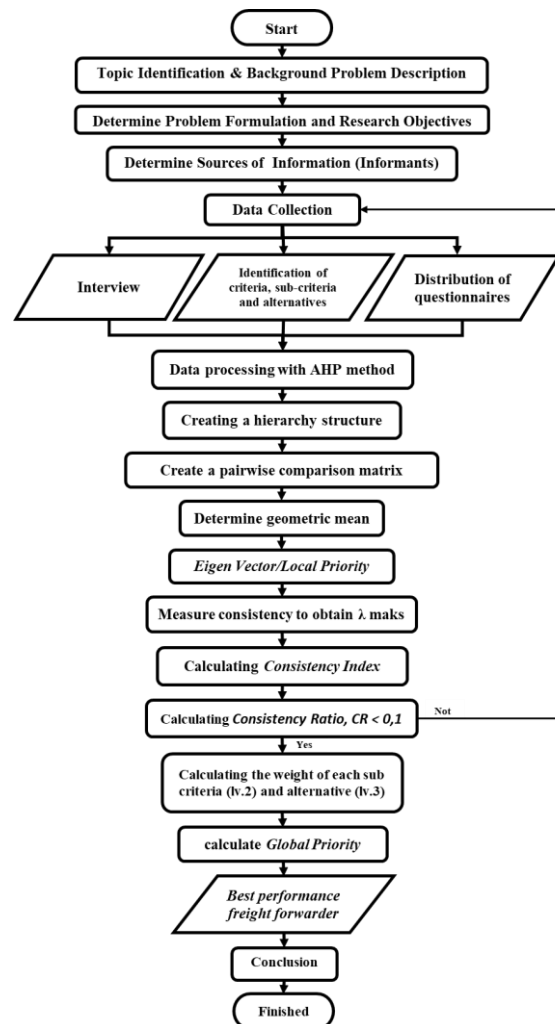


Figure 1: Research Flow and Data Processing Techniques

Source: Processed data (2023)

RESULTS AND DISCUSSION

The criteria selection in this study draws upon the literature studies conducted by Pramita and Wirawan (2019) and Wulan and Hendrawan (2018), further validated through insights gleaned from conducted interviews. This rigorous approach ensures the suitability of the identified criteria for evaluating the freight forwarder services of PT XYZ. The ensuing data processing steps undertaken by researchers are detailed as follows:

1. Creating a hierarchy structure

The problem hierarchy in this study is structured across three levels. At level 0, the overarching objective is established: the application of the Analytical Hierarchy Process (AHP) to assess freight forwarders. Level 1 identifies the criteria employed in this evaluation, while level 2 delves into sub-criteria. Finally, level 3 catalogues alternative forwarders, culminating in the selection of the optimal performer denoted as Freight Forwarders A.

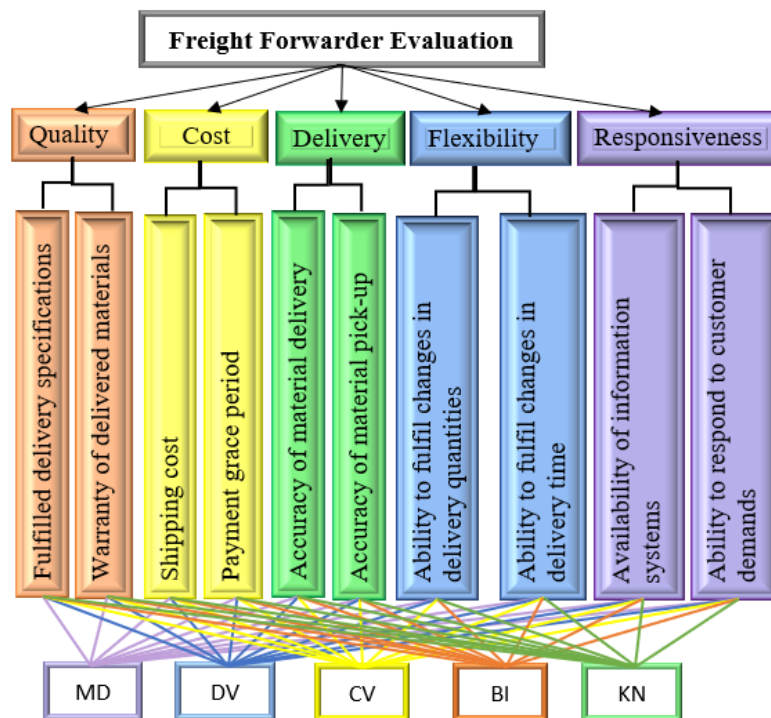


Figure 2: Hierarchy Structure of Freight Forwarder Evaluation

Source: Processed data (2023)

2. Creating a pairwise comparison matrix.

Data gathered from distributed questionnaires among three sources within PT XYZ are integrated into a pairwise comparison matrix, employing a rating scale ranging from 1 to 9.

Table 3: Pairwise Comparison Rating Scale

Important Level Scale	Definition
1	Equally important
3	Slightly more important
5	More important
7	Very important
9	Absolutely more important
2,4,6,8	Middle value
Opposite	$A_{ij} = 1/A_{ji}$

Source: Saaty in Ervil & Rahman (2019)

3. Determination of Geometric Mean

Due to the involvement of multiple sources, the geometric mean is computed initially to amalgamate the data into a unified pairwise comparison matrix.

Table 4: Pairwise Comparison Matrix Between Criteria

Criteria	Quality	Cost	Delivery	Flexibility	Responsiveness
Quality	1,00	0,46	0,15	0,61	0,15
Cost	2,17	1,00	0,43	1,79	0,58
Delivery	6,80	2,33	1,00	1,79	0,58
Flexibility	1,64	0,56	0,56	1,00	0,43
Responsiveness	6,84	1,71	1,71	2,34	1,00
Total	18,45	6,06	3,85	7,53	2,74

Source: Processed data (2023)

4. Determination of Eigen Vector/Local Priority.

Subsequent to the computation of the pairwise comparison matrix, a normalization process is initiated, yielding priority weights as depicted in the ensuing table.

Table 5: Pairwise Comparison Matrix Between Normalized Criteria

Criteria	Quality	Cost	Delivery	Flexibility	Responsiveness	Total	Weight/Priority
Quality	0,05	0,08	0,04	0,08	0,05	0,30	0,06
Cost	0,12	0,17	0,11	0,24	0,21	0,85	0,17
Delivery	0,37	0,38	0,26	0,24	0,21	1,46	0,29
Flexibility	0,09	0,09	0,15	0,13	0,16	0,62	0,12
Responsiveness	0,37	0,28	0,44	0,31	0,36	1,77	0,35
Total	1,00	1,00	1,00	1,00	1,00	5,00	1,00

Source: Processed data (2023)

Notably, from the normalized criteria comparison table, responsiveness emerges with the highest weight, underscoring its pivotal role in the evaluation of freight forwarders.

5. Consistency Measurement (λ max)

Consistency measurement is executed by multiplying each column of the pairwise comparison matrix, prior to normalization, with the corresponding eigen vector or weight.

$$\begin{pmatrix} 1,00 & 0,46 & 0,15 & 0,61 & 0,15 \\ 2,17 & 1,00 & 0,43 & 1,79 & 0,58 \\ 6,80 & 2,33 & 1,00 & 1,79 & 0,58 \\ 1,64 & 0,56 & 0,56 & 1,00 & 0,43 \\ 6,84 & 1,71 & 0,71 & 2,34 & 1,00 \end{pmatrix} \times \begin{pmatrix} 0,06 \\ 0,17 \\ 0,29 \\ 0,12 \\ 0,35 \end{pmatrix} = \begin{pmatrix} 0,31 \\ 0,85 \\ 1,53 \\ 0,63 \\ 1,85 \end{pmatrix}$$

$$\begin{pmatrix} 0,31 \\ 0,85 \\ 1,53 \\ 0,63 \\ 1,85 \end{pmatrix} / \begin{pmatrix} 0,06 \\ 0,17 \\ 0,29 \\ 0,12 \\ 0,35 \end{pmatrix} = \begin{pmatrix} 5,09 \\ 5,05 \\ 5,21 \\ 5,14 \\ 5,21 \end{pmatrix}$$

$$\lambda \text{ maks} = \frac{(5,09 + 5,05 + 5,21 + 5,14 + 5,21)}{5} = 5,14$$

6. Consistency Index Calculation

$$CI = \frac{\lambda \text{ maks} - n}{n - 1}$$

$$CI = \frac{5,14 - 5}{5 - 1}$$

$$CI = 0,03$$

7. Consistency Ratio Calculation

$$CR = \frac{CI}{RI}$$

$$CR = \frac{0,03}{1,12}$$

$$CR = 0,03$$

8. Perform the same calculation for sub-criteria and alternatives.

9. Global Priority Calculation

The global weight is obtained by multiplying the local priority by the priority level above it.

Table 6: Global Priority

Level 1 (criteria)	Level 2 (sub criteria)	Global Weight	Alternative (Forwarder)	Global Weight
Quality 0,06	Fulfilled delivery specifications 0,65	0,039	MD	0,013
			DF	0,002
			CV	0,015
			BI	0,007
			KN	0,002
	Warranty of delivered materials 0,35	0,021	MD	0,010
			DF	0,001
			CV	0,006
			BI	0,003
			KN	0,001
Cost 0,17	Shipping cost 0,67	0,114	MD	0,066
			DF	0,014
			CV	0,008
			BI	0,010
			KN	0,015
	Payment grace period 0,33	0,056	MD	0,032
			DF	0,003
			CV	0,009
			BI	0,008
			KN	0,004
Delivery 0,29	Accuracy of material delivery 0,81	0,235	MD	0,083
			DF	0,017
			CV	0,080
			BI	0,038
			KN	0,016
	Accuracy of material pick-up 0,19	0,055	MD	0,024
			DF	0,003
			CV	0,018
			BI	0,006
			KN	0,004
Flexibility 0,12	Ability to fulfil changes in delivery quantities 0,13	0,016	MD	0,008
			DF	0,001
			CV	0,003
			BI	0,002
			KN	0,001
	Ability to fulfil changes in delivery time 0,87	0,104	MD	0,048
			DF	0,006
			CV	0,033
			BI	0,011
			KN	0,006

Level 1 (criteria)	Level 2 (sub criteria)	Global Weight	Alternative (Forwarder)	Global Weight
Responsiveness 0,35	Availability of information systems 0,21	0,074	MD	0,044
			DF	0,005
			CV	0,011
			BI	0,008
			KN	0,005
	Ability to respond to customer demands 0,79	0,277	MD	0,117
			DF	0,016
			CV	0,098
			BI	0,031
			KN	0,015

Source: Processed data (2023)

The global priorities table reveals the top three influential criteria in this study. Responsiveness secures the foremost position, attaining a weight of 0,35, followed by delivery ranking second with a weight of 0,29, and cost ranking third with a weight of 0,17. Similarly, the most influential sub-criteria are identified, with the ability to respond to customer demands claiming the top position with a weight of 0,277, followed by the accuracy of material delivery at second place with a weight of 0,235, and shipping costs securing the third position with a weight of 0,114.

Subsequently, to ascertain the priority weight of each forwarder, the results entail summing the products of the priority weights for each alternative element collectively.

Table 7: Overall Forwarder Weights

Forwarder	Weight	Ranking
MD	0,444	1
CV	0,282	2
BI	0,124	3
KN	0,071	4
DF	0,070	5

Source: Processed data (2023)

According to the aforementioned table, MD forwarders attain the highest rank, securing a weight of 0,444. Following closely, forwarder CV claims the second position with a weight of 0,282, while forwarder BI secures the third rank with a weight of 0,124. Meanwhile, forwarder KN occupies the fourth position with a weight of 0,071, and forwarder DF concludes with the lowest rank, obtaining a weight of 0,070.

For a comprehensive understanding of the weight attributed to each criterion across all alternative forwarders, please refer to the table below.

Table 8: Alternative weights for each criterion as a whole

Criteria	MD	DF	CV	BI	KN
Quality	0,022	0,004	0,020	0,010	0,003
Cost	0,098	0,017	0,018	0,018	0,020
Delivery	0,107	0,021	0,098	0,044	0,020
Flexibility	0,056	0,007	0,036	0,013	0,007
Responsiveness	0,161	0,021	0,109	0,039	0,020

Source: Processed data (2023)

According to the data presented in the table above, MD emerges as the frontrunner, boasting the highest assessment weight across all criteria. This underscores MD's superior performance in comparison to the remaining four forwarders.

In the realm of pairwise comparison assessments, consistency is upheld when the computed consistency ratio (CR) remains below 0,1. Conversely, if the CR value exceeds this threshold, the assessment is deemed inconsistent, prompting the need for refinement to ensure the accuracy and reliability of the evaluation process.

Table 9: Recapitulation of CR Value

Pairwise Comparison	CR	Description
Between criteria	0,03	Consistent
Between sub-criteria quality	0,00	Consistent
Between sub-criteria cost	0,00	Consistent
Between sub-criteria delivery	0,00	Consistent
Between sub-criteria flexibility	0,00	Consistent
Between sub-criteria responsiveness	0,00	Consistent
Between alternatives (level 3) against sub-criteria fulfilled delivery specifications	0,01	Consistent
Between alternatives (level 3) against sub-criteria warranty of delivered materials	0,06	Consistent
Between alternatives (level 3) against sub-criteria shipping cost	0,04	Consistent
Between alternatives (level 3) against sub-criteria payment grace period	0,07	Consistent
Between alternatives (level 3) against sub-criteria accuracy of material delivery	0,05	Consistent
Between alternatives (level 3) against sub-criteria accuracy of material pick-up	0,04	Consistent
Between alternatives (level 3) against sub-criteria ability to fulfil changes in delivery quantities	0,06	Consistent
Between alternatives (level 3) against sub-criteria ability to fulfil changes in delivery time	0,05	Consistent
Between alternatives (level 3) against sub-criteria availability of information systems	0,03	Consistent
Between alternatives (level 3) against sub-criteria ability to respond to customer demands	0,04	Consistent

Source: Processed data (2023)

The table above reveals a consistency ratio (CR) of $< 0,1$ for all pairwise comparisons among criteria, sub-criteria, and alternatives, affirming the data's consistency. This study diverges from Wulan and Hendrawan's (2018) findings, which prioritize cost as the main criterion. Instead, responsiveness emerges as the primary criterion in this research. This variance stems from PT XYZ's contractual emphasis on cost considerations. Nevertheless, cost remains pivotal for PT XYZ, albeit ranking third in priority within this study's framework.

For PT XYZ, responsiveness plays a pivotal role in evaluating freight forwarder services, given its reliance on forwarders for delivering finished goods to customers. Effective responsiveness facilitates swift and accurate resolution of issues such as incorrect deliveries, delayed shipments, and goods damaged in transit, thereby enhancing overall service quality and customer satisfaction.

CONCLUSION

Based on the assessment of freight forwarders using the AHP method at PT XYZ, the following conclusions are drawn:

Table 10: Overall VPI Criteria and Sub Criteria Weights

VPI Criteria	Weight	Sub Criteria	Weight
Quality	0,06	Fulfilled delivery specifications	0,039
		Warranty of delivered materials	0,021
Cost	0,17	Shipping cost	0,114
		Payment grace period	0,056
Delivery	0,29	Accuracy of material delivery	0,235
		Accuracy of material pick-up	0,055
Flexibility	0,12	Ability to fulfil changes in delivery quantities	0,016
		Ability to fulfil change in delivery time	0,104
Responsiveness	0,35	Availability of information systems	0,074
		Ability to respond to customer demands	0,277

Source: Processed data (2023)

1. The three most influential criteria in evaluating forwarders are as follows:
 - a. Responsiveness holds the highest priority, with a weight value of 0,35.
 - b. Delivery follows as the second priority, with a weight value of 0,29.
 - c. Cost is designated as the third priority, with a weight value of 0,17.
2. The three most influential sub-criteria in evaluating forwarders are delineated as:
 - a. The ability to respond to customer demands ranks highest, with a weight value of 0,277.
 - b. Accuracy of material delivery secures the second priority, with a weight value of 0,235.
 - c. Shipping costs are deemed third in priority, with a weight value of 0,114.
3. Interpretation of the three most influential freight forwarder criteria
 - a. Responsiveness which consists of sub-criteria availability of information systems with a weight value of 0,074 and ability to respond to customer demands with a weight value of 0,277 according to PT XYZ is the most important thing in evaluating freight forwarders because accurate and complete information can help operational transparency so that companies can monitor

and manage shipments more effectively. The ability to respond to customer demands can make issue handling more effective and efficient and will increase customer satisfaction.

- b. Delivery which consists of sub criteria accuracy of material delivery with a weight value of 0,235 and accuracy of material pick-up with a weight value of 0,055 is the second priority for PT XYZ, because the accuracy of delivery can enhance the company's reputation as a reliable partner and can reduce the additional costs associated with late delivery of goods. The accuracy of material pick-up will be able to avoid stock vacancies and disruptions in the supply chain.
 - c. Cost which consists of sub criteria shipping cost with a weight value of 0,114 and payment grace period with a weight value of 0,056 is the third priority for PT XYZ, because competitive prices can minimise shipping costs and increase operational efficiency. Then with payment grace period the company can avoid late payment penalties which can reduce operational costs.
4. Forwarder MD emerges as the top performer, garnering a weight value of 0,444. Following closely, forwarder CV is identified as the second priority, with a weight value of 0,282. Forwarder BI claims the third priority, with a weight value of 0,124, while forwarder KN and forwarder DF are ranked fourth and fifth, respectively, with weight values of 0,071 and 0,070.

Given the paramount importance of responsiveness in evaluating forwarders at PT XYZ, forwarder MD emerges as the preferred choice. Its superior responsiveness and adept handling capabilities are instrumental in minimizing customer complaints and shortening delivery times. Therefore, forwarder MD stands out as the optimal long-term partner for PT XYZ, boasting the highest evaluation value and weight values across both main criteria and sub-criteria. This underscores MD's superiority in mitigating customer complaints compared to the other forwarders.

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