Third Party Logistics Selection in Fast Moving Consumer Goods using AHP Method: A Case Study at PT.PZC

Kuwat Suroto[1], Hasbullah Hasbullah[2]
{surotokuwat@gmail.com[1]}

Master of Industrial Engineering Program, Universitas Mercu Buana, Jakarta, Indonesia
Jl. Meruya Selatan, Kembangan, Jakarta Barat 11650[1,2]

Abstract. The rapid development of industrie also brings an increase in the level of business competition. A competitive business strategy is needed to answer the challenges of business competition for fast moving consumer good company. The marketing areas that are spread across Indonesia and abroad have made the supply chain performance of the company an important thing in the company. The purpose of this research is determining which criteria is more important than the others in an third party logitistic (3PL) selection. Therefore, these criteria used to evaluate each 3PL services so the best. Method used in this research is analytical hierarchy process (AHP). The result of this research is logistics costs criteria is more important in an 3PL selection compared than responsiveness, location, information technology and services quality most important criteria in ranking performance to capture variability in decisions extended AHP as a very useful tool.

Keywords: Vendor Selection; Third Party Logistics; AHP

1 Introduction

Distribution will involve a third party as a bridge to fulfill a chain process good supply. The process of distributing goods is determined from the performance of each logistics vendor who used. Logistics services have shown a positive trend in the last few years in Indonesia. One of the reasons is the increasing consumption power of the people. This is followed by increasing competition in the logistics sector so that service providers must have their own competitive advantage. Commonly used criteria are safety, quality, delivery, morale and cost Hartono[4]. Ken Research data on Indonesia Logistics and Warehousing Market by Sector (2018) said that as the fourth most populous country in the world with strong growth prospects and market potential, Indonesia is a magnet for global investors. Indonesia has the largest economy in Southeast Asia with a large service sector contribution. With a population of more than 270.02 million people spread over 17,500 islands (Source SP: BPS 2020), the logistics sector in Indonesia is very important in connecting people and businesses. However, based on the Logistic Performance Index, Indonesia's ranking has improved from the previous year to position 46 out of 160 countries based on world bank data, as shown in Figure 1.1.

ICSST 2021, November 25, Tangerang, Indonesia

DOI 10.4108/eai.25-11-2021.2318835

Vendor is one part of supply chain that is important and will affect company performance. Therefore, the company needs to assess the vendor or suppliers carefully and precisely. Election vendor is a strategic activity, especially if the vendor will supply the item important and will be used in the long term long. So, for a smooth process production must know in advance the most important criteria to be used benchmark in vendor selection.

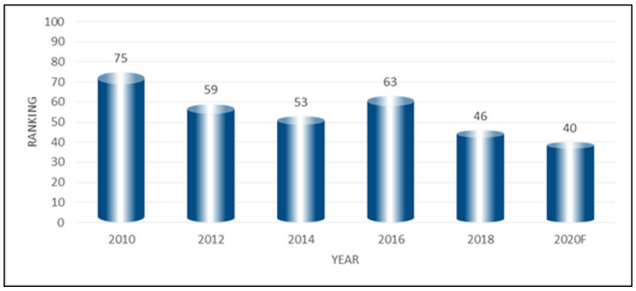

Fig. 1. Logistics Performance Index (LPI) Indonesia Ranking
Source: lpi.worldbank.org (2020)

The competitiveness of outsourcing logistics to third party logistics (3PL) has become a distinct source of advantage for most manufacturing companies. Most companies cite greater flexibility, operational efficiency, better customer service, and being able to focus on their core business as part of the benefits of using 3PL (Angkiriwang et al., 2014). Competitive opportunity for investment at ASEAN as shown in Figure 2.

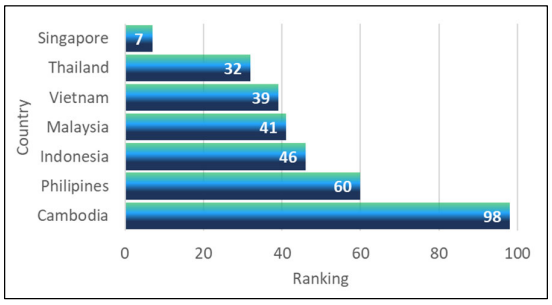

Fig. 2. ASEAN Opportunity for Investment Ranking
Source: lpi.worldbank.org (2020)

Vendor selection effectiveness is considered essential to success organization. Researchers agree about importance of vendors and providing resources in managing services in the organization. Product distribution costs are considered the dominant cost in some companies Asamoah [14]. This illustrates the importance of strong collaboration between organizations and vendors because they relate with lower cost, quality and innovation in business, helping organizations achieve competitive advantage sustainable. Henceforth, organization must find a way to choose the best among Them to become their partners in the chain supply. Effective approaches can be used to find the appropriate vendor. We use AHP to find the best vendors in this research. There are multiple studies in the literature that apply AHP to select vendors. The following is a summary of these studies: Several methods were used in food vendor

selection Ikinci[6], furniture vendor selection Ersoy,[2], retailer vendor selection Praveena, 2020[13], biomass vendor selection Lou [8], city hub location selection Hemmelmayr [5].selection humanitarian aid vendor Venkatesh [11], cement vendor selection industry Narkhede [9]. This paper focus on proposing a general, comprehensive vendor selection for lead logistic provider to allow any related industries such as food & beverage, pharmacy, fast moving consumer good and telecommunication industries to apply the methodology with regard to their focus business system by considering appropriate criteria, sub criteria and distribution model. PT. PZC as a consumer good company for foreign investment in Indonesia must be able to make changes and improvements in order to compete with similar companies such as Unilever, Johnson & Johnson and so on. The selection of the right partner to distribute the product is an important point.

Fig. 3. Supply Chain Management
Source: https://www.pengadaan.web.id

Problems on the part of PT. PZC dedicated manufacturing industry and based on decision for distribution, managing logistics process needed to handed over to 3PL done experience manage the distribution and network. There is sometimes the vendor has good criteria only in one side like speed in send while on the other hand like the price still not fulfilled. Company needs selecting vendors with the right method in order to get the best suitable vendor with the criteria required by the company.

2 Mehodology

2.1 Third Party Logistics (3PL)

Third party logistics (3PL) is a third-party company that provides logistics service outsourcing services, either to companies or individuals. The services provided can be for one or more functions in a supply chain management, especially in warehouse and distribution matters. Thus, this 3PL logistics company will become a partner in managing all transportation and warehouse needs end-to-end Kaye, 2019 [7]. Outlines the steps involved in establishing and establishing a relationship with the 3PL. For illustration purposes, Assume the model should be used from the perspective of a manufacturing company, as it investigates the possibilities of establishing a connection with a third-party logistics provider, figure 4. According to García Reyes, 2013 [3] the logistics party is a third party (3PL) that provides services logistics with a company that provides products or services with a certain contract.

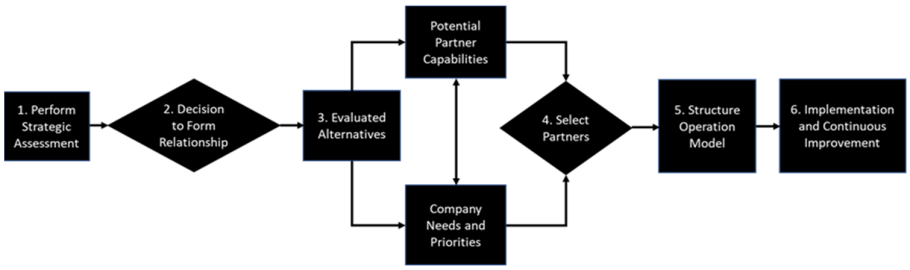

Fig. 4. Third Party Logistic Relationship Development Proses
Source: (Kaye, 2019)

2.2 Analytical Hierarchy Process (AHP)

In a multi-objective judgment problem, Saaty's AHP explains how to determine the relative importance of a cluster of options.. The process allows for incorporating judgments on intangible qualitative criteria in addition to real quantitative criteria The AHP method is characterized by three principles: the model's structure, a comparative assessment of alternatives and criteria, and cumulative priority. A complex decision problem is organized in a hierarchy in the first stage. The original AHP breaks down multi-criteria decisions in to the simple steps. problems in a hierarchy of interrelated decision criteria, decision alternatives. In every levels, criteria are compared in pairs according to their degree of influence and based on the criteria specified in the higher level. In AHP, some pairwise comparisons are based on a comparison scale. Basically the mathematical formulation of multi-criteria with the AHP model is carried out by using a matrix. In an operating subsystem there are n elements operations, namely the operation elements A1, A2, …, An , then the result of comparison is Pairs of the elements of the operation will form a comparison matrix. Pairwise comparisons start from the highest level of the hierarchy, where a criterion used as the basis for making pairwise comparisons as below:

Table 1.. Pairwise Comparison

	$\mathbf{A_1}$	$\mathbf{A_2}$	**…**	$\mathbf{A_n}$
A_1	a_{11}	a_{12}	…	a_{1n}
A_2	a_{21}	a_{22}	…	a_{2n}
…	…	…	…	…
A_n	a_{n2}	a_{n2}		a_{nn}

The rating scale on this AHP uses a scale of 1 to 9 which means: illustrates the importance of one element over the other elements. Following is a table showing the rating scale for comparison. The final consistency ratio (CR), which is generated as the ratio of the CI and the random index, can be used to evaluate whether the ratings are sufficiently consistent.

$$CR=CI/RI \quad (1)$$

The consistency ratio should be less than 0.1.

Tabel 2. Comparasion Scale (Özkan et al., 2011)

Intensely of importance	Definition
1	Equally important
3	Moderately more important
5	Strongly more important
7	Very strong more important
9	Extremely more important
2,4,6,8	Intermediate more important

Source : Thomas L. Saaty, 1980

Users of the AHP method may fill in priority values (data comparison between a pair of criteria) which is inconsistent. If this is the case, then the solution produced by the AHP method is not the best. To find out the level consistency of user input, the AHP method must be accompanied by Index calculation Consistency (Consistency Index). After obtaining the consistency index, then the result is compared to the Random Consistency Index (RI) for every n objects. Table 3.2. shows the R.I. for every n objects (2 n 10). C.R. (Consistency Ratio) is the result of a comparison between the Consistency Index (C.I.) and Random Index (R.I.). If CR 0.10 (10%) means that the user's answer is consistent so that the resulting solution is optimal.

Tabel 3. Random index value

n	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
R.I.	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

Source : Thomas L. Saaty, 1980

2.3 Vendor Selection with AHP

In this article, we have selected the best vendor to manage lead logistic provider. They should manage warehouse, transportation, and trucking availability and have to dedicated on the best supplier with a 5 years contract period. Therefore, they decided to determine the best provider using AHP. There are 4 main criteria, 16 sub-criteria and 3 potential providers: X, Y and Z. The hierarchy of the problem is shown in Fig. 4.1. In the AHP method, criteria are usually set in the form of a hierarchy. Criteria and sub-criteria in this study are the criteria and sub-criteria obtained from literature study Ozkan[9]. Vendor evaluation is carried out by experts. Experts be using the Saaty scale of 1 to 9 to answer their polls and calculate scores. After each expert having taken a turn answering the poll, the average is calculated and the evaluation is done. Pairwise comparison is done by comparing one element to another. Number obtained from the results of the completed questionnaire respondents are then processed with a matrix AHP method. Weighted Geometric Mean Complex (WGMC) which is a resume the results of the paired matrix are in Table 1 and Table 2.

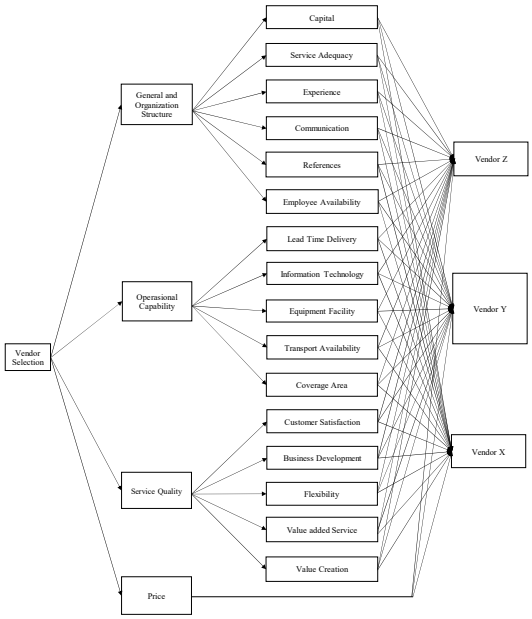

Fig. 5. Hierarchical Structure Selected Vendor

Tabel 4. Weighted Geometric Mean Complex (WGMC) between Vendor each Criteria

Vendor	X	Y	X
X	1.000	9.000	3.000
Y	0.111	1.000	1.000
Z	0.333	1.000	1.000

The reference weight is the weight of the criteria obtained from an average of 3 (three) respondent weight This reference weight will be used in the vendor selection system to assess the weights that local respondents consider important, have an effect on the system vendor selection. After getting the three consistent data that can be used as a reference, then the average weight of each criterion and sub-criteria will be calculated used as a reference weight in the vendor selection system. Here is a table averaged reference weight:

Tabel 5. The weight criteria

Criteria	Sub Criteria	Weight
Price (0.4201)		
Service quality	a) Value Creation	0.2304
(0.3820)	b) Value added Service	0.4131
	c) Flexibility	0.1844
	d) Business Development	0.1150
	e) Customer Satisfaction	0.0611
Operational capability (0.1202)	a) Coverage Area	0.1946
	b) Lead Time Delivery	0.1406

Criteria	Sub Criteria	Weight
	c) Equipment Facility	0.1162
	d) Information Technology	0.2301
	e) Lead Time Delivery	0.3536
General and Organization Structure (0.1010)	a) Employee Availability	0.1367
	b) References	0.1809
	c) Communication	0.0771
	d) Experience	0.1485
	e) Service Adequacy	0.2564
	f) Capital	0.3354

Tabel 6. Vendor Priority

Potential Vendor	Weight	Ranking
X	0.5327	I
Y	0.3879	II
Z	0.0816	III

3 Results and Discussion

The AHP was used to evaluate the decision-making process since the criteria were both qualitative and quantitative in our case. According to the AHP research, the most important criterion generally service quality, although value-added service and delivery time are really the least important sub-criteria. Price is the most important ranking criteria, which is determined by service quality, operational capability, and, general organizational structure. In this case, the company's management must focus on establishing criteria and their weights using good specific. The advantages resulting by the company from the 3PL modification were evaluated two years later in order to demonstrate the effectiveness of the reorganization, methodology, and selection. In particular, by outsourcing the warehouse and distribution management of its finished goods to a single partner whose been selected as the best solution by the MCDM method, the organization could save money and effort.

Every company optimizes the upstream members (vendors) and downstream members (customers) for better operating performance in logistics management. Companies also may discuss private information with cooperative enterprises in order to achieve improved performance of the supply chain. Therefore in scenario, three options are evaluated in addition to making a more informed choice. Based on the book information, the group selection members choose the best partner. The AHP methodology is considered in this research to find the best vendor for lead logistics provider. The best vendor alternative is established to be X, while the second best alternative is determined to be Y, and the worst alternative is determined to be Z. An possible research option for future work on vendor selection optimization is detailed transportation rate. Coordinating detailed scheduling with both the vehicle routing problem framework is a sensitive procedure which requires and use of both specific information systems and robust scheduling models.

4 Conclusion

The following can be concluded after carrying out all stages of research using the analytical hierarchy process method in terms of criteria selection and related relationships:

a) The AHP method has been used to develop the framework. Companies can use this to establish more appropriate decision in the selection of 3PL vendors, enabling companies to speed up the process and minimize losses due to vendor selection errors.
b) The criteria in the evaluation of third-party logistics provider selection, with the selection of third-party logistics provider providers, it is supposed to improve the company's service but since vendors identified are the best. The loss generated by inconsistencies in vendor selection can already be eliminated by applying AHP testing.

References

[1] Angkiriwang, R., Pujawan, I. N., & Santosa, B. (2014). Production & Manufacturing Research : An Open Access Journal Managing uncertainty through supply chain flexibility : reactive vs . proactive approaches. Production & Manufacturing Research: An Open Access Journal, July 2014, 37–41. https://doi.org/10.1080/21693277.2014.882804

[2] Ersoy, Y. (2021). Selection of The Best Supplier in Furniture Industry by Using Fuzzy Analytic Hierarchy Process Method (pp. 219–236). https://doi.org/10.4018/978-1-7998-5886-7.ch012

[3] García Reyes, L. E. (2013). Transportation: A Supply Chain Perspective. In Journal of Chemical Information and Modeling (Vol. 53, Issue 9)

[4] Hartono, M., Santoso, A., Tanugraha, M. B., Prayogo, D. N., & Kusumo, A. H. (2018). Kansei Engineering, Kano, & Triz for Logistic Service ExcellenceNo Title. http://repository.ubaya.ac.id/33889/17/Kansei Engineering_TRIZ_Kano di Industri Logistik.pdf

[5] Hemmelmayr, V. C., & Vienna, W. U. (2020). Analytic hierarchy process for city hub location selection - The Viennese case. Transportation Research Procedia, 46, 77–84. https://doi.org/10.1016/j.trpro.2020.03.166

[6] Ikinci, M., & Tipi, T. (2021). Food supplier selection in the catering industry using the analytic hierarchy process. Food Science and Technology. https://doi.org/10.1590/fst.48420

[7] Kaye, I. (2019). Transportation A Supply Chain Perspective. In Rural Society in the U.S.: Issues for the 1980s. https://doi.org/10.4324/9780429305153-18

[8] Lou, Y., Feng, L., He, S., He, Z., & Zhao, X. (2020). Logistics service outsourcing choices in a retailer-led supply chain. Transportation Research Part E: Logistics and Transportation Review, 141, 101944. https://doi.org/10.1016/j.tre.2020.101944

[9] Narkhede, B. E., Raut, R., Gardas, B., Luong, H. T., & Jha, M. (2017). Selection and evaluation of third party logistics service provider (3PLSP) by using an interpretive ranking process (IRP). Benchmarking: An International Journal, 24(6), 1597–1648. https://doi.org/10.1108/BIJ-04-2016-0055

[10] Özkan, B., Ba, H., & Nergis, Ş. (2011). Supplier Selection Using Analytic Hierarchy Process : An Application From Turkey. Proceedings of the World Congress on Engineering 2011 Vol II WCE 2011, July 6 - 8, 2011, London, U.K. Supplier, II(July 6-8, 2011), 4–9

[11] Praveena, J., & Devi, P. M. P. (2020). Fuzzy Analytical Hierarchy Process in Selection of a Seventh Party Logistics (7PL). International Journal of Mathematics Trends and Technology (IJMTT), 66(3), 18–27
[12] Venkatesh, V. G., Zhang, A., Deakins, E., Luthra, S., & Mangla, S. (2019). A fuzzy AHP-TOPSIS approach to supply partner selection in continuous aid humanitarian supply chains. Annals of Operations Research, 283(1–2), 1517–1550. https://doi.org/10.1007/s10479-018-2981-1
[13] Saaty, T.L., 1980, The Analytic Hierarchy Process, McGraw-Hill, New York
[14] Asamoah, D., J, A., dan N, S. (2012). AHP Approach for Supplier Evaluation and Selection in a Pharmaceutical Manufacturing Firm in Ghana. International Journal of Business and Management. 7(10), 49-62
[15] Logistic Performance Index 2018.https://lpi.world.bank.org/international/global/2018