Vendor Performance Evaluation Using Kraljic's Purchasing Portfolio Matrix and Analytic Hierarchy Process Method (Case study: PT Pertamina Trans Kontinental Central Jakarta)

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Abstract: Vendor performance evaluation is one of the factors supporting the company's business because having a good quality vendor can indirectly improve the company's performance and have an impact on the company's profitability. The research was conducted based on criteria using the Vendor Performance Indicator (VPI), namely Quality, Cost, Delivery, Flexibility, Responsiveness, at PT Pertamina Trans Kontinental, Central Jakarta. The use of the Analityc Hierarchy Process (AHP) method is carried out to measure the performance of several vendors and the results obtained for vendor L get the highest weight compared to other vendors, namely 2.076, vendor A (2.045), vendor B (2.017), and vendoir K (1.985). Classification of items is also carried out using the Kraljic's Matrix method and is divided into four quadrants, namely the Leverage quadrant containing Rope, Turalic, Gasket and Ship Paint, with the recommendation of a call of contract strategy. The Non-critical quadrant contains Camera, Antenna, Radio, Dapra Chain, Battery, Aluminium Anode, and Dry Battery, with recommendations for regular trading and purchasing card strategies. The Strategic quadrant contains Filter, Main Engine, Cable Shore Connection, and Liferaft, with recommendations for partnership contract and accept a locked-in strategy. While the Bottleneck quadrant contains Impeller, Pasut, Power Supply, Dapra Tyre, and HRU EPIRB with the recommendation of a call of contract strategy. Based on these results, the company can see the assessment of several vendors and implement strategies that have been suggested by classification using the Kraljic's matrix analysis method.

Keywords: Analytic Hierarchy Process, Kraljic's Purchasing Portfolio Matrix, Procurement, Supply Chain Management, Vendor Performance Evaluation.

Abbreviations:
AHP : Analytic Hierarchy Process
CR : Consistency Ration
KPM : Kraljic's Purchasing Portfolio Matrix
MADM : Multi Attribute Decision Making
PTK : PT Pertamina Transkontinental
VPI : Vendor Performance Indicator

Introduction

Procurement activities are closely related to vendors or suppliers, because vendors have the responsibility to provide the company's raw materials. The quality of a company's products and services will be directly related to the quality of its suppliers and the services they offer. In addition, companies require an effective and effective procurement strategy to ensure that the suppliers they choose are of the highest quality. (Verma & Pullman, 1998).

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The reason for doing the vendor analysis was that PT Pertamina Trans Kontinental Central Jakarta was having problem implementing a reliable method of evaluation for several of its vendors. Aside from that, the company is currently searching for suitable criteria to evaluate each vendor's performance. The company also does not have an appropriate procurement strategy by classifying the vendors it has according to their type. This classification helps companies understand which vendors are in the critical group or cannot be replaced, and which vendors are in the non-critical group, which means the vendor can be replaced with another vendor.

Therefore, the purpose of this study was to evaluate the performance of each vendor within the PTK Group and to develop an efficient and appropriate procurement strategy for each vendor owned. This research was conducted using two methods, namely Kraljic's Purchasing Portfolio Matrix (KPM) and Analytic Hierarchy Process (AHP). KPM was chosen because it serves to classify vendor items that are critical to the company and the development of appropriate strategies will be carried out to minimize the resulting risks. Kraljics's portfolio matrix is an effective tool for discussing, visualizing, and illustrating the possibilities of developing differentiated procurement strategies (Gelderman &; Van Weele, 2005). Then, AHP was chosen because it serves to assess the performance of each vendor, where the method is one of the methods in Multi Attribute Decision Making (MADM) by measuring through pair comparisons in order to determine the weight of each decision based on the assessment results (Saaty, T., 2008).

Several studies have examined the two principles and models of the approach in advance when conducting research on the selection of vendors or suppliers using the AHP method and Kraljic's Portfolio Matrix. Some of these papers end up being used as references by researchers. Rinaldo and Susanti (2019), Pujotomo, et al (2018), Pramita and Wirawan (2019), Bhatt, Guru, Thanki, & Sood (2021), Erdebilli et al. (2023) are a few studies on AHP. Kraljic's Portofolio Matrix has also been the subject of other investiations, including those by (Kusumawati &; Sari, 2018), Thesno (2016), Huatagoi, et al (2020), Burlakova (2021), Garzon, Enjolras, Camargo, & Morel (2019), Stange, Schiele, & Henseler (2022).

Materials and Methods

Kraljic's Purchasing Portfolio Matrix

Kraljic's Purchasing Portfolio Matrix is a method used for classifying products in a portfolio matrix based on two dimensions: profit impact and supply risk (low and high). The resulting matrix is then categorised into four groups: bottleneck, non-critical, leverage, and strategic items. (Gelderman &; Van Weele, 2005). Kraljic underlined the need for a strategy based on the value of a purchasing in value added a product with its impact on profitability-his. Profit impact what is meant is the influence that has a direct impact on the company's profits, so that the company can develop. In addition, another factor is complexity supply which is measured by the scarcity of goods, the speed of material flow, cost, and monopoly conditions. Type Kraljic's can help the buyer's understanding for classifying goods or services based on profit impact and supply risk. After knowing the classification of each product, a strategy will be made according to the classification of each product (Gelderman & Mac Donald, 2008).

Table 1. Kraljic's Purchasing Portfolio Matrix Strategy (Gelderman & Mac Donald, 2008).

Items	Holding the Position	Moving to Another Position
Leverage	Partner convivence	Develop a strategic partnership (moving to strategic)
Bottlenecks	Reduce the negative consequences	Reduce dependence and risk (moving to non-critical)
Non-critical	Individual ordering	Pooling of requirement (moving to leverage)
Strategic	Accept the locked-in partnership	Terminate partnershipFind new supplier (moving to leverage)

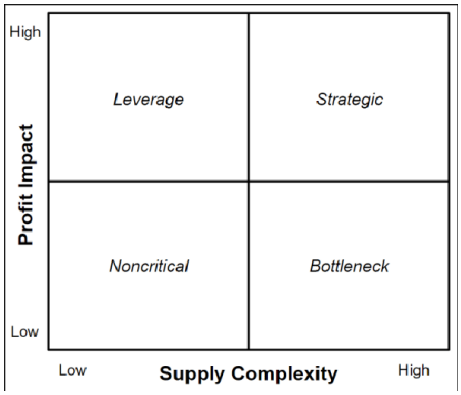

Figure 1. Kraljic's Purchasing Portfolio Matrix Strategy (Gelderman & Mac Donald, 2008)

Procurement items performed on quadrants **Leverage** characterized by low supply risk but high total cost. On the quadrant leverage, the purchasing strategy will be directed at the exploitation of purchasing power. Products included in the quadrant are products that have enormous value, where profit impact and supply risk very high. Then for the quadrant **Strategic**, have recommendations for supplier management that is to maintain and develop strategic partnerships. In quadrants **Noncritical**, it is recommended to make purchases on a regular basis. Purchases are made only when needed and pursue processing efficiently. Meanwhile, in the quadrant **Bottlenecks**, the purchase recommendation strategy in this quadrant is on average based on acceptance of dependency and reduction of the negative impact of unprofitable positions. Another strategy is to find other suppliers and move towards the noncritical quadrant (Gelderman & Van Weele, 2003).

Analytic Hierarchy Process

Analytic Hierarchy Process (AHP) is a method developed by Thomas L. Saaty (1997). This method is an effective decision-making method on a complex problem with a simplification process by classifying the parts of variables into a hierarchical structure, assigning numerical values with subjective consideration of how important each variable is, to determine which variable has the highest priority to influence the final outcome in the situation (Yancadianti, 2015).

According to Sasangko, Astuti, &; Maharani (2017), the working principle of AHP is simplification of complex unstructured problems, strategic, and dynamic consisting of parts arranged in a hierarchy. The importance of each variable will be given a numerical value subjectively which indicates how important the variable is by comparing each other with other variables. According to Saaty, T. (1994) AHP has three principles of problem solving, namely the principle of hierarchy (Decomposition), Principles of determining priorities (Comparative Judgement), and the principle of logical consistency (Logical Consistency). Here are the steps in doing AHP:

1. Specify the type of criteria to be used. Determination of the type of criteria to be used in conjunction with the creation of a hierarchical structure appropriate to the objectives.

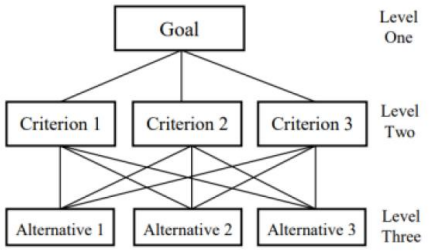

Figure 2. Simple Hierarchical Tree (Taherdoost, 2017)

2. Arrange these criteria into the form of a matrix in pairs. In filling the pairwise comparison matrix, the decision making will be assisted by the following scale:

Table 2. Relative Rating Scale (Saaty, T., 1994).

Importance	Definition
1	Both elements are very important
3	One element is slightly more important than the other
5	One element is very important compared to the other
7	One element is really more important than another
9	One element is absolutely more important than another
2, 4, 6, 8	A middle score given when there is doubt between two assessments

3. Calculate eigen value and eigen vector. The result of the eigenvector will be multiplied by a parameter number which will later be called the

eigenvalue. The following is the form of the equation:

$$A.W = \lambda.W$$

With:
W = eigenvector
λ = eigenvalue
A = Matrix

4. Consistency ration (CR) calculation

The next step is to calculate the consistency ratio (CR) which can be accounted for (consistent) if the CR value ≤ 0.1 and vice versa if the CR value > 0.1, there will be inconsistency and must be re-filled. Thus, it is expected that the decisions taken are close to valid.

Table 3. Random Consistency Index (Taherdoost, 2017)

Dimension	RI
1	0
2	0
3	0,5799
4	0,8921
5	1,1159
6	1,2358
7	1,3322
8	1,3952
9	1,4537
10	1,4882

Data Analysis

KPM and AHP methods are used to process data. KPM is used as an approach to classify vendors according to the types they have, as well as grouping them into a matrix. Next, AHP is used to identify the goal, namely to evaluate vendors by forming a hierarchy and providing criteria to be assessed, which is then weighted to assess each vendor and look for vendors with the best quality.

Results and Discussion

Kraljic's Purchasing Portfolio Matrix

Data processing uses kraljic's portfolio matrix where the X-axis uses supply risk where the level of difficulty is assessed using the supply risk management table. Then for the Y-axis is profit impact which is the influence of suppliers on the company's profit gain. The following is the result of classification using kraljic's matrix concept.

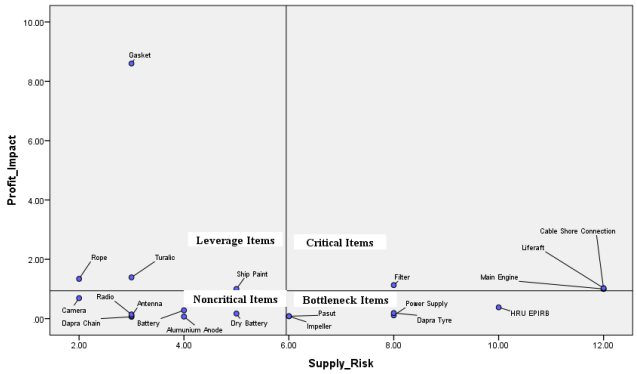

Figure 3. Kraljic's Purchasing Portfolio Matrix Model of the items of each vendor of the company PT Pertamina Transkontinental Jakarta Pusat.

Based on the classification using Kraljic's Purchasing Portfolio Matrix shown in figure 2, it can be seen that the collection of items retrieved through company data is placed in the quadrant of kraljic's model through multidimensional scaling with SPSS software. In the leverage quadrant, these items have the main characteristics of low supply risk and have a high impact on profits. These items are rope, gasket, ship paint, and turalic. The right strategy recommendation for raw materials in strategic items is that companies are advised to conduct a thorough vendor selection, so that companies can pressure vendors to provide prices that are profitable enough for the company through call of contracts.

In the noncritical quadrant, these items have the main characteristics of low supply risk and have a low impact on profits. Items included are cameras, radios, dapra chains, batteries, antennas, aluminum anodes, and dry batteries. The right strategy recommendation for raw materials in noncritical items is to have vendors located not far from the company or company branch where the raw materials are stored. Having a vendor close to the company's location can facilitate the flow of the raw material purchasing process, so that the purchasing process from vendor to company can be more efficient. The company also does not have to establish a special relationship with vendors by implementing regular trading contracts

In this quadrant strategic items have the main characteristics of high supply risk and have an

impact on high profits. Items included are filters, cable shore connections, main engines, and liferafts. The right strategy recommendation for raw materials in strategic items is a partnership contract. With this partnership contract, the company also does not need to worry about the availability of raw material supply, because there is already a long-term contract between the two parties. The strategy of accepting a locked-in partnership also often occurs, where companies must submit to unfavorable vendor conditions and cannot get out of the situation. This position can be caused because the vendor holds full related to the main raw materials of the company, and is a situation dominated by vendors.

In the bottleneck quadrant, these items have the main characteristics of high supply risk and have an impact on low profits. Items included are impeller, pasut, power supply, dapra tire, and HRU EPRIRB. The right strategy recommendation for raw materials in bottleneck items is to have vendors with characteristics that are trusted in terms of quality and easy to maintain raw material standards. In addition, the company must also be able to maintain good relations with vendors, in this case the company can apply a contract in the form of a call of contract.

Analytic Hierarchy Process

The criteria used in the measurement of the company's vendor PT Pertamina Trans Kontinental Central Jakarta consist of 5 selected criteria, namely Quality, Cost, Delivery, Flexibility, and Responsive. Using the five selected criteria, a description will be carried out regarding the substance of each criterion based on the Vendor Performance Indicator (VPI).

Table 4. Measurement of Influential Vendor Performance at PT Pertamina Transkontinental Jakarta Pusat.

Criterion	Eigen Vector	Rank	Sub Criteria	Eigen Vector	Rank	A	B	K	L
Quality	0.28	1	Quality of Raw Materials	0.525	1	0.338	0.319	0.292	0.309
			Warranty Provision	0.334	2	0.094	0.091	0.107	0.084
			Bug Fixes	0.142	3	0.010	0.017	0.017	0.023
Cost	0.26	2	Competitive Price	0.536	1	0.276	0.260	0.260	0.271
			Price Details	0.249	2	0.072	0.068	0.068	0.063
			How to Pay	0.136	3	0.018	0.023	0.023	0.023
			Negotiation	0.079	4	0.005	0.006	0.006	0.006
Delivery	0.26	2	Delivery Schedule Accuracy	0.466	1	0.235	0.237	0.202	0.270
			Damage Prevention	0.294	2	0.069	0.089	0.096	0.063
			Booking Compatibility	0.160	3	0.030	0.020	0.026	0.022
			Accuracy of Raw Material Quantity	0.080	4	0.006	0.005	0.006	0.005
Flexibility	0.10	3	Speed of Response to Complaints	0.525	1	0.305	0.319	0.327	0.357
			Anticipating Factory Needs	0.334	2	0.103	0.091	0.080	0.067
			Providing Requested Data Information	0.142	3	0.016	0.017	0.019	0.017
Responsive	0.10	3	Product Response Speed	0.106	3	0.013	0.017	0.017	0.013
			Replacement of Damaged Raw Materials	0.633	1	0.385	0.373	0.373	0.431
			Shipping Suitability	0.260	2	0.071	0.066	0.066	0.052
			Final Priority Value			2.045	2.017	1.985	2.076
			Rating			2	3	4	1

Table 5. Classification of Vendor Alternatives According to Key Criteria

Alternative *Supplier*	Quality	Cost	Delivery	Flexibility	Responsive
A	**0.442**	**0.371**	0.340	0.424	0.469
B	0.427	0.356	0.351	0.427	0.455
K	0.417	0.356	0.330	0.426	0.455
L	0.416	0.363	**0.361**	**0.441**	**0.496**

Based on the performance measurement of several vendors using the AHP method, namely Vendor A, Vendor B, Vendor K, and Vendor L, it was decided that Vendor L had the highest priority weight with a value of 2.076, after that vendor A had the second priority weight with a value of 2.045, then vendor B has the third priority weight with a value of 2.017, and vendor K has the lowest priority weight with a value of 1.985. The AHP method was chosen because by using this method, companies can see and assess performance for each company vendor. Using this AHP method, companies can provide an assessment in the form of numbers that explain the weighting for each of these vendors. Based on the recapitulation of the previous performance measurement in table 5, the vendor with the best overall weight is vendor L. If the company wants a vendor recommendation with the best total assessment is vendor L with a weight of 2,076. However, if the company wants a vendor with each of the best criteria, it is vendor A who excels in quality criteria with a weight of 0.442 and cost with a weight of 0.371, and vendor L who excels in delivery criteria of 0.361, flexibility of 0.441, and responsiveness of 0.496.

Conclusions

The classification of items using Kraljic's Purchasing Portfolio Matrix method is divided into four quadrants, namely the Leverage Items quadrant containing Rope, Turalic, and Ship Paint, the Noncritical Items quadrant containing Camera, Radio, Dapra Chain, Battery, Aluminum Anode, and Dry Battery. The Strategic Items quadrant contains the Filter, Main Engine, Cable Shore Condition, and Liferaft, and the Bottleneck Items quadrant contains the EPIRB Impeler, Peg, Power Supply, Dapra Tire, and HRU. Each quadrant has different characteristics and different strategies to be applied. For items in the Leverage quadrant, companies should use a call of contract strategy in finding suppliers, for noncritical quadrants companies should use regular trading and purchasing card strategies, and companies should look for suppliers with the closest location distance to the company. For the strategic quadrant, companies should use partnership contract strategies and accept a locked-in, while for bottleneck quadrants, companies should use a call of contract strategy.

In the overall calculation for the alternative weight of vendors or suppliers, the highest weight for the Quality criterion is Vendor A of 0.442 and the lowest weight is Vendor L of 0.416. For alternative Cost criteria, the highest weight is obtained by Vendor A at 0.371 and the lowest weight is Vendor B and K at 0.356. In the alternative Delivery criteria, the highest weight was obtained by Vendor L of 0.361 and the lowest weight was obtained by Vendor K. In the alternative Flexibility criterion, the highest weight was obtained by Vendor L of 0.441 and the lowest alternative weight was obtained by Vendor A of 0.424. In the last criterion, namely Responsive alternatives, the highest weight was obtained by Vendor L of 0.496, while for alternatives with the lowest weight was obtained by Vendor B and Vendor K of 0.455. Based on the results of measuring the performance of the entire vendoe through several criteria and sub-criteria, Vendor L was obtained which had the best performance among other vendors PT Pertamina Trans Kontinental Central Jakarta with a value weight of 2,076, while the vendor with the lowest performance was obtained by Vendor K with a value weight of 1,985.

Conflict of Interest: The authors declare that there are no conflicts of interest concerning the publication of this article.

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