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Procurement Strategy in Power Plant Companies (Case study in the supply of water generator engine parts)

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Abstract. PT XYZ is one of the power generation companies that conduct electricity production process by utilizing energy coming from water to rotate turbine. The problem faced is about maintenance infrastructure that is delays procurement of spare parts item. One effort that can be done is to improve procurement efficiency. Procurement efficiency can be accomplished by designing a procurement strategy covering twenty-two important parts, by determining the type of relationship, contract type, contract term, operational strategy and employee characteristics of procurement of parts and helping to achieve efficiency in the procurement process of spare parts which often experience delays. The design is based on the coordinate point position of the spare parts item in Kraljic Portfolio Matrix consisting of supply risk dimension with 12 criteria and profit impact with 6 criteria. In the strategic quadrant, design is done by considering Supplier Perception Model consisting of dimension of level of attractiveness and value of business.

1. Introduction

Procurement is the process of obtaining goods or services to meet needs so that the process of activities can proceed according to planning. Procurement activities will be beneficial if the goods or services needed can be purchased at the best cost to meet the needs of buyers in quality, quantity, time and location [1]. The procurement process, suppliers are needed as providers of needs [2]. In obtaining appropriate needs, good management is needed between buyers and suppliers. Supplier relationship management that is well managed will affect the performance of the company's supply chain that will increase effectively [3].

PT XYZ is a subsidiary of the State Electricity Service (PLN) which is a State-Owned Enterprise (BUMN) which operates in the field of electricity production to distribution to PLN. PT XYZ is a generator that converts motion energy into electricity using water. Based on the initial interview, PT XYZ had a problem in the supply chain, namely in infrastructure maintenance activities, PT XYZ often encountered problems, one of which was the delay in procuring components. These problems occur due to several factors, namely incompatibility of usage specifications and delays in delivery. As a result, the electricity production process can be disrupted and incur additional costs. There are several costs that can be directly calculated and there are some uncountable costs that can have a large impact on the company's performance in the long term.

PT XYZ has a policy if the components/spare parts do not meet the specifications will be returned to suppliers and suppliers must replace these parts with additional time that affects the idle engine, electricity production will be reduced or the company must do overtime. Therefore, the planning to procure machine parts must be appropriate so as not to inhibit the electricity production process. The



technique used to design a procurement strategy is to use the development of the Kraljic portfolio matrix method and the supplier's perception model with the AHP and TOPSIS methods.

2. Method of the Research

2.1. Procurement

Procurement is an activity to obtain goods or services in a transparent, effective and efficient manner based on the needs and desires of users [4]. The internal procurement section serves to provide information (supplier capacity, logistics data, information about charging prices and discounts on new products) to other parts or functions and internal violations are responsible for activities [5] procurement related to their needs. For external procurement is a procurement activity that is responsible for the cost of goods or services, delivery period, product quality and procurement decisions, such as supplier selection and supplier relationships.

2.2. Supplier Relationship Management

Supplier Relationship Management is an understanding of design based on supplier procurement policies, strategic procurement and operational processes and configuration [6]. Supplier Relationship Management is a procedure for managing the relationship of a company's interaction with providers of goods or services with the aim of facilitating relations between the two parties so that activities become effective [7].

2.3. Analytic Hierarchy Process

Analytic Hierarchy Process (AHP) is a measurement theory that exists in MADM (multi attribute decision making) by doing pairwise comparisons on criteria with an assessment that comes from experts to get a priority scale [8]. AHP Steps [9] :

1. Determine the problem
2. Determine Priority Elements
3. Synthesis of measurement results.

2.4. Technique for Other Preference by Similarity to Ideal Solution

Technique for Others Preference by Similarity to Ideal Solution (TOPSIS) is a principled method that the chosen alternative must have the closest distance to the positive ideal solution and the farthest distance from the negative ideal solution [10] :

Topsis steps:

1. Form a decision matrix
2. Normalize the decision matrix
3. Determine the weight of the normalization of the decision matrix
4. Determine positive ideal solutions and negative ideal solutions
5. Calculating the distance between alternatives to positive ideal solutions and negative ideal solutions.

2.5. Kraljic Matrix Portfolio

The Kraljic matrix portfolio is the development of purchasing strategies undertaken by Kraljic to create effective supply chain management. Kraljic (1983) also stated that purchases must have their own supply management. The types of purchasing management applied in companies, including material management, purchasing management, resource management, and inventory management and Kraljic stated that supply management can be applied to supply high risk and urgency conditions [1]. On that basis, Kraljic made a purchase portfolio model that classifies purchase items based on the impact of profit and risk supply with four on the 2x2 matrix into 4 categories, namely non-critical, bottleneck, leverage, and strategic items.

2.6. Supplier Perception Model

Supplier Perception Model is a tool used to analyze the motivation or interest of suppliers of goods/services to procurement that will be carried out [11].

SPCM is a model that describes the views/perceptions/interests of providers of goods/services to buyer/agent organizations. This perception is based on the value of procurement and the level of interest/motivation of the providers of goods/services in offering goods/services.

3. Research Method

This research has the following research steps:

1. Preliminary Study
2. Literature Study
3. Research Design

This research is a qualitative and quantitative descriptive research, with an analysis model using the Kraljic matrix portfolio and supplier perception model. In determining risk is carried out with quantitative technology, namely the distribution of questionnaires to stakeholders of companies that understand procurement activities in the company. The results of the questionnaire distribution will be processed using the AHP and TOPSIS methods, where the results of the processing will determine the coordinates of the Kraljic matrix portfolio and the strategic quadrant is determined by the supplier perception model.

4. Research Variables

In this study using to plotting spare parts items on the Kraljic matrix portfolio used variables derived from previous research and to find out the perception of providers conducted research [11].

5. Research Instruments
6. Data Collection

The data used in this study consists of two types, qualitative data which includes data from interviews with company stakeholders and providers and quantitative data which are the results of questionnaire data with both primary and secondary data sources. There are two stages of questionnaire distribution, the first stage is to find out the influential criteria in determining the procurement strategy in the company and the second stage questionnaire to determine pairwise comparisons of the weighting of influential criteria.

Data processing is done by validating the criteria that influence the determination of the procurement strategy, the influential criteria will be calculated the dimensions of supply risk and the dimensions of the impact of profit using the AHP method. The results of the criteria weight calculation will be processed by using the TOPSIS method to determine the coordinate points of each spare item in the Kraljic Portfolio Matrix. The strategic quadrant determines the perception of the provider by conducting interviews and the results of the interview function to determine the coordinates of the Supplier Perception Model [11].

The results of the two methods will be analysed to determine the right procurement strategy, so that a strategic plan can be obtained which can be a suggestion for the next period's spare parts procurement process.

4. Analysis and Discussion

4.1. Influence Criteria Validation

Based on the results of the Phase I questionnaire, which was filled by five respondents, the results obtained from the criteria that will be used in the study through the calculation of the mean value. This calculation is done to find out the influential criteria and become the input criteria for the phase II questionnaire. The following is Table 1 and Table 2 the results of the calculation of the mean in the phase I questionnaire.

Table 1. Mean Dimensions of Supply Risk

Recap of Supply Risk Results						
Respondents	1	2	3	4	5	Mean
Criteria						
AVA	4	2	4	4	5	3.8
TA	5	3	5	4	5	4.4
NUS	4	4	4	4	4	4
SP	3	3	3	4	4	3.4
LC	3	2	3	3	5	3.2
SR	4	3	4	4	4	3.8
CD	3	2	3	4	2	2.8
MBO	3	2	4	2	2	2.6
EB	3	4	3	4	3	3.4
LT	5	4	5	5	5	4.8
CR	4	4	4	3	4	3.8
CIP	5	3	5	5	5	4.6
PC	4	2	4	3	4	3.4
LRF	4	3	4	4	4	3.8
CUD	2	2	2	4	3	2.6
SI	2	2	2	3	4	2.6

Table 2. Mean Profit Impact Dimension

Recap of Profit Impact						
Respondents	1	2	3	4	5	Mean
Criteria						
PV	3	3	3	4	4	3.4
TPC	5	3	5	5	4	4.4
QOI	5	5	5	5	5	5
BG	5	3	5	5	4	4.4
VAP	5	4	5	5	5	4.8

Based on the calculation of the mean above, have a mean above 3. On the criteria of competitive demand, make or buy opportunities, cultural differences and supply interruptions have a mean below 3. So the criteria these are not used in determining procurement strategies.

4.2. Determination of Coordinate Points in the Kraljic Matrix

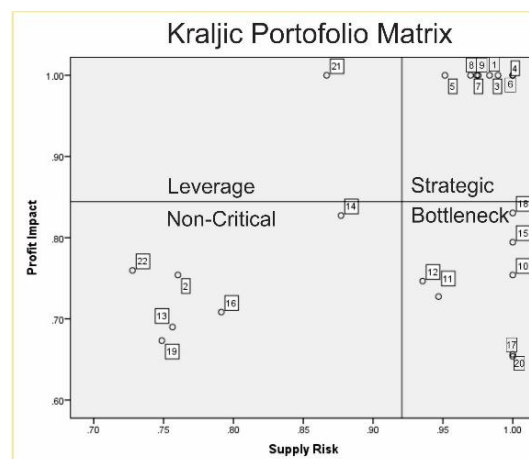
Determination of coordinate points is done by using the TOPSIS method to get the C * value of all the parts of the plant engine parts under study. The following is table 3, which is a recapitulation table of coordinates of spare parts items.

Table 3. Points of coordinates for each item

No.	Spare parts items	Supply Risk	Profit Impact
1	Filter Governor	1	1
2	Baterai Unit	0.760272	0.754081
3	Pressure Gauge	0.98337	1
4	Shaft Sleeve	0.989455	1
5	Seal Packing	0.9514471	1
6	Sensor & Meter	1	1
7	Sheel Diala	0.96977	1
8	Pipa Radiator	0.974197	1
9	Temperature Gauge	0.975311	1
10	U Packing	1	0.754081
11	Gasket U Packing	0.946876	0.727447
12	Relay Travo	0.935466	0.746571
13	Seal Servometer	0.756387	0.689963
14	Contactora MCC	0.877069	0.827278
15	Mobil DTE	1	0.794429
16	Booster Pump	0.791321	0.708346
17	Water Level	1	0.653788
18	Tools OH	1	0.830437
19	Coating Compound	0.748752	0.673216
20	GCB	1	0.656354
21	Material control	0.866754	1
22	EDG	0.72776	0.759678

4.3. Plotting Items on Kraljic Matrix

Planning spare parts items is done with the help of SSS software by planning items based on C * values. The following is a Figure 1. Kraljic Matrix diagram on each item.

**Figure 1.** Kraljic Matrix Diagram

In Figure 1, it appears that all spare parts items fill each quadrant, while the fourth quadrant dividing line is determined by adopting the IPA method.

4.4. Plotting Supplier in SPM Diagram

Plotting the data in the supplier perception model diagram is done by considering the mean value of the value of business and the level of attractiveness as a coordinate point. Plotting is done with the help of SPSS software. The following is Figure 2 diagram of supplier perception model for suppliers on strategic dimension parts.

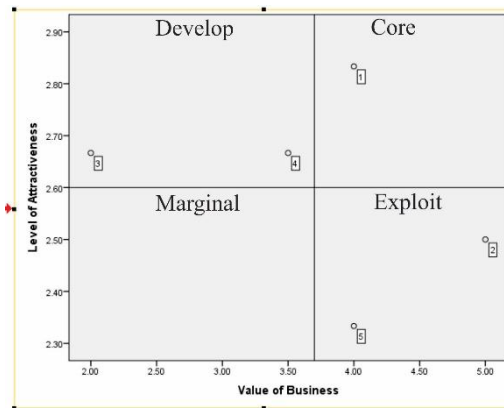


Figure 2. SPM Diagram

Based on Figure 2, it can be seen that there are no suppliers in the marginal quadrants. The fourth dividing line is determined by adopting the IPA method.

4.5. Analysis of The Highest Weight Criteria

After determining the influential criteria, we calculate the weight for each selected criterion in each dimension for all spare parts procurement items.

In the supply risk dimension there are five criteria that have the highest weight for some spare parts items, such items are availability, technology advance, number of suppliers, entry barrier and lead time. These criteria mean that in determining the procurement strategy these five criteria are taken into consideration in determining the procurement strategy.

In the profit impact dimension there are four criteria that have the highest weight. These criteria include purchased volume, total purchased cost, quality of items and value-added profile. This shows that the four criteria are taken into account by the company in determining the procurement strategy.

4.6. Leverage Quadrant Analysis

In the leverage quadrant there is only one spare part item. This quadrant is a quadrant with a low supply risk but has a high impact on profits.

Items in the leverage position are items with the most favorable position for the company. So the type of relationship that should be done is arm-length with the type of spot purchase order contract with a midterm relationship period.

4.7. Strategic Quadrant Analysis

In the strategic quadrant there are eight spare parts. Strategic quadrants are quadrants with a high supply risk and have an impact on high corporate profits as well.

Generally, items that are in the strategic quadrant tend to be special with a small number of suppliers. So the type of relationship that should be done is a partnership with the type of partnership contract with a long term relationship period.

4.8. *Non-Critical Quadrant Analysis*

In the non-critical quadrant there are six spare parts. Non-critical quadrants have a low supply risk and the impact on company profits is also low.

Items in this quadrant are usually standardized with a large number of suppliers. So the type of relationship that can be done is arm-length with the type of fixed contract with a long-term relationship period.

4.9. *Bottle-neck Quadrant Analysis*

In the bottle-neck quadrant there are seven spare parts. The quadrant bottle-neck is a quadrant that has a high supply risk but the impact on company profits is low.

Generally, items in this quadrant have special specifications and a small number of suppliers. So that the type of relationship that can be done is a partnership with the type of partnership contract with a special approach and long-term relationship period. It aims to avoid things that are not desirable because companies that are highly dependent on suppliers.

4.10. *Develop Quadrant Analysis*

There are two suppliers in the develop quadrant. Develop quadrants are quadrants where the provider is interested in considering business development even though the purchasing value is low. Providers are ready to invest time and effort in developing long-term relationships with companies with the aim of increasing sales. Doing business with suppliers in the quadrant is very suitable because the company is in a dominant position.

4.11. *Core Quadrant Analysis*

There is one supplier in the core quadrant. The quadrant core is a quadrant where the provider considers the company as the core of the business, because the provider considers that the company is a potential business partner. In this condition the provider will try to maintain business with the company, so that it will cause the company to be in a dominant position.

4.12. *Exploit Quadrant Analysis*

In the exploit quadrant there are two suppliers. A quadrant exploit is a quadrant where the spare parts item is very important but the supplier considers that the business activity is less attractive to the provider. Providers in this quadrant hope that the business activities they run do not interfere or make the provider spend excessive effort. In this condition it is necessary to have some specific approaches, because if providers consider that business activities are safe, they will be able to exploit the company as an example of raising prices.

4.13. *Combination of KPM and SPM*

After the analysis is carried out, a combination of the Kraljic matrix portfolio and supplier perception model is then carried out to obtain an appropriate procurement strategy. It is found that:

Spare parts items in the leverage quadrant are determined by the type of relationship that can be applied is Arm-length, the type of Spot Purchase Order contract with a Mid-term Relationship period (half production period). The operational strategy that can be applied is Benchmarking with similar companies with the characteristics of employees who are able to carry out technical procurement assessments and have broad insight and information.

Spare parts items in a strategic quadrant are determined by the type of relationship that can be applied is a partnership, type of partnership contract with a long-term Relationship period (one or two production periods). Operational strategies that can be applied are managing relationships with both parties, reducing the cost of the purchase process and reducing distribution costs with the characteristics of

employees who are able to carry out technical procurement assessments and understand the characteristics of spare parts items

Spare parts items in non-critical quadrants are determined by the type of relationship that can be applied is Arm-length, type of contract type fixed contract with long-term Relationship period (one production period). The operational strategy that can be applied is the use of e-commerce and the automation of the procurement process with the characteristics of employees who are orderly and responsible

Spare parts items in the bottleneck quadrant are determined by the type of relationship that can be applied is partnership, type of partnership contract with long-term Relationship period (one or two production periods). Operational strategies that can be applied are specific approaches with suppliers, holding stock calculations and consignment contracts with employee characteristics that are capable of carrying out technical assessments, knowing supply risks and being able to calculate safety stock.

4.14. Supplier Criteria Based on SPM

After doing the research, there are several supplier criteria that can be used as a reference in selecting suppliers including suppliers who are interested in doing business with the company, suppliers that offer the highest quality items, suppliers who are in good financial condition and able to commit to business activities as well as possible.

5. Conclusion

Based on the results of the study it can be seen that there are five criteria in the supply risk dimension, namely availability, technology advance, number of suppliers, entry barrier and lead time and four criteria on the dimensions of profit impact, namely purchased volume, total purchased cost, quality of items and value add profile which has the highest weight.

Determination of the procurement strategy is done by combining the Kraljic Matrix portfolio method and the supplier perception model method with the aim of obtaining an appropriate procurement strategy because in terms of two perceptions namely the company and the provider.

Determination of supplier criteria can be done based on the results of the study using the supplier perception model method that can be a reference for the company in selecting suppliers in carrying out their business activities.

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