Strategic Framework Supply Chain through Kraljic Purchasing Portfolio in O&M Power Plant Company

M Zemmy1*, Rianti Setiyowati2

1Pembangkitan Jawa Bali Services, Raya Bandara Juanda 17 Street, Sidoarjo, Indonesia
2Pembangkitan Jawa Bali, Ketintang Baru 11 Street, Surabaya, Indonesia
Corresponding author: *m.zemmy@ptpjbs.com

Abstract. This paper aims to determine a flexible and extensible model (strategic framework) in classifying the needs of materials/services as a procurement guideline for the company’s operating and maintenance service providers (O&M) power plants. PT PJB Services is a service provider of O&M which leads the market by managing power plants scattered across various islands facing problems related to the delay supply of spare parts. One of the efforts that can be done is to increase the efficiency of the procurement process by determining the model to identify important supply chains. This Model was obtained by the analysis of purchase portfolio using the Kraljics matrix. The design is based on a spare part position in the Kraljic portfolio Matrix consisting of a dimension of risk procurement and impact profit. The application of this model enables the determination of the critical company in the high lead time problem and the provider of materials/services involved. Analysis of critical needs position (including the suppliers involved) in the Kraljic matrix allows can be defined some strategies that may be applied to the lead time reduction.

1. Introduction
Supply Chain Management (SCM) is an important function in advancing the competition in the industry[1]. The SCM strategy is to integrate buyers and suppliers to increase responsibility and flexibility in the company’s supply processes[1]. Procurement is the process of obtaining materials or services to meet the needs of supply so that the process of corporate activities can continue according to plan. Procurement activities will be beneficial if the materials or services needed can be purchased at the best cost to meet the needs of the buyer in quality, quantity, time and location [2]. For a long time, the purchase was part of the company’s supply chain business and has become important, the company began to focus on minimizing the total cost [3]. In the procurement process, Supplier acts as a provider of needs [4]. In obtaining the right needs, good management between buyers and suppliers is required. The good management between suppliers and management will effectively affect the performance of the company’s supply chain improvement [5]. Supplier involvement in the positive supply chain affects the realization of new products, resulting in reduced cost, quality and quick release in the market. Choosing a supplier and deciding on a supplier strategy is one of the major keys for an effective, optimized and accountable supply chain. Suppliers ensure the constant flow of materials and products, and they are involved in the broad part of the business, above all due to the growing tendency to outsource logistics, manufacturing, marketing and product development activities [6].

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PT PJB Services manages power plants with a total capacity of 5,295 MW for 107 power plants with a company operating area spread over thirty locations throughout Indonesia. PT PJB Services is the market leader in power plant management services in Indonesia and the affiliates of the State Electricity Company (PLN) which is the State-Owned Enterprise. Since 2014, the company has run a wider business scope to be able to provide optimum services to meet the operational and maintenance needs of the power plant with two main product categories namely operation & maintenance (O&M) and Maintenance, Repair, and overhaul (MRO). This business scope offers a supply of human resources with the application of asset management supported by the information management system. The success of the company's business in managing power generation assets is highly dependent on supply chain management such as supplier management, spare parts inventory, effective and efficient procurement processes to improve power generation performance. The decentralization SCM management is faced with constraints that the duration of the procurement process (lead time) has not been effective which has the potential to cause delays in the arrival of spare parts and job completion service. 32.9% of the procurement process done in 2018 was delayed as the number of procurement processes increased by 43.3% over the previous year. Consequently, the electricity production process can be interrupted, and additional costs arise. PT PJB Services has a policy if the spare parts do not meet the specification will be returned to the supplier and should replace that will cause the engine to become idle, electricity production will be reduced and have a big impact on the performance of the company. Delays show that supply chain systems have not been effective and efficient with procurement activities that are still highly bureaucratic, clerical, still focused only on the lowest price, the use of information systems that are still limited, and cooperation with suppliers that are still very transactional. This indicates a "passive" condition in which existing system are based on strategies and programs that respond only to requests from other functions so that the time required for materials/services has not been met with the time required in the procurement process (Lead time of the procurement process) and has not been able to respond to cost leadership issues.

Therefore, the integration and alignment of purchases into corporate strategy planning can create a competitive edge [7]. Choosing the right strategy can reduce low-quality suppliers, increase company performance productivity and cost effectiveness. For this reason, the company focuses on fostering supplier relationships to ensure overall organizational performance, increase competitiveness and increase long-term success as a result of improved efficiency and services, mitigating risk and reducing market entry time [8]. The right choice of source strategy depends on several factors [9]. The analysis of the purchase portfolio, developed by Kraljic in 1983, is a consolidation approach that includes, firstly, the classification of good purchased and, secondly, the strength evaluation of the supply market [10]. About the classification of good purchased, this method considers both the importance of purchased items and the complexity of market supply and recommends product categorizing in terms of the impact of profit (high/low) and the risk of supply (high/low), creating a $2 \times 2$ matrix [10].

The main purpose of this analysis is the identification of strategic items, which are elements with high profit impacts and high supply risks. Regarding the market strength evaluation, the purchase portfolio analysis aims to evaluate the relative position of the company in the supply market, distinguishing the three types of relationships with the previously identified strategic item suppliers: exploitation in case of buyer domination, balance in case of balanced and diversified relationships in regard to supplier domination. Different tactics are also elaborated for other matrix cells [11]. Leverage, non-critical, congestion and strategic items and recommendations for their purchase are defined as shown in Figure 1. In the purchase analysis experience, practitioners are accustomed to implementing different strategies in the same matrix cells in relation to the position of the item. Especially when choosing the right strategy, they can choose to move the product in a different matrix cells [12]. Previous research has shown that large corporations recognise the importance of strategic purchases as a tool to achieve higher quality, increased operational flexibility, shorter time and reduced costs.
2. Method

This paper is an analysis of the framework of the approach that will be used in the concept of analysis to develop strategic framework in the form of supply positioning matrix analysis. The implementation of a purchase portfolio analysis is obtained by selecting and weighting different parameters, which influence the supplier’s position in the Kraljic matrix, in relation to the company strategies and requirements.

![Purchasing Portfolio Analysis](image1)

**Figure 1.** Purchasing Portfolio Analysis, modified from Kraljic classification of purchased items and relatively strategic recommendation [11].

This model is implemented in Excel in order to help the company provide a simple and flexible instrument, which is also useful for future development. Figure 2 shows the main step of the adopted methodology adopted.

![Main Step Method](image2)

**Figure 2.** Main Step Method
2.1. Description of the company’s supply chain
The company conducts O&M activities for power generation with the support of external suppliers supplying spare parts or repair services, manufacturing or reconditioning of generator equipment. Selection of the supplier is done through procurement process according to specification requirements or scope of needs. Figure 3 shows the schematic display of the enterprise supply chain O&M power plant.

![Figure 3. Structure of the supply chain of the analysed company](image)

2.2. Procurement target
Next, is determining what targets the company will achieve in relation to the procurement process in 2020-2024. This target will then be the target and the indicator of the skeleton strategy to be formulated. This objective is based on internal analysis, external, and industrial analysis, where the objectives are as follows:
1. Lead time fulfillment, how each procurement proposal can be executed on time according to the requirement date, including how the delivery of materials/services reached 6 (six) rights (6 RS): appropriate quality, quantity, time, place, socio-economic goals, and price. The lead time is targeted to be reduced to below 10% of all procurement processes in the year 2020.
2. Cost leadership, that is, how to build a higher economic scale or have an advantage in productivity. In other words, the company directs itself to be a low-cost manufacturer in the industry for each level of quality with a minimum cost reduction target of 5% in the year 2020.

2.3. Purchasing portfolio analysis
The Kraljic matrix application was originally used to classify product purchases and guidance in procurement decisions but it is also possible in conducting typological categorization and product suppliers as in this study.

Step 1: Pareto analysis. The first step in a model app is the Pareto analysis, which only selects the most important supplier. Suppliers are listed in descending order according to the value of purchase realized by the company. The three classes that have been identified are as follows: Class A to 80 percent of the total value of the company's purchase, class B to 15 percent of the total purchase value and class C for the remaining 5 percent of the total purchase value.

Step 2: With the Kraljic approach the criteria option is performed by classifying each supplier in terms of profit impact and inventory risk. These two aspects are chosen in relation to corporate strategy and market trends. Each criterion is evaluated along with the procurement manager and then positioned on the scale. There are four factors affecting the company's success in the market, its cost (world price, domestic price, inventory fee, cost-based activity, total management cost, etc.), quality
(product quality, service quality, reliability, etc.), time (long-term agreements, flexibility, short lead times, material requirements, etc.) and technology (commodity leaders, equipment, processes, innovations, visions, etc.). For each material/service need, weights can be determined for each factor (the relative weight of the market's success). The amount of profit impact weights resulted from the sum of all the weight multiplication of each factor with material influence, they are positioned on a scale between 0 and 5 as shown in table 1

**Table 1. Influence profit impact**

| Criteria   | A Market Success Relative Weight | B Influence of Material (Scale 0-5) | C Weighted Influence (A x B) |
|------------|---------------------------------|-----------------------------------|-----------------------------|
| Cost       |                                 |                                   |                             |
| Quality    |                                 |                                   |                             |
| Time       |                                 |                                   |                             |
| Technology |                                 |                                   |                             |
| Total      | 1.0                             | Sum of C’s = influence index      |

The risk of supply is a market complexity and can identify suppliers that suppliers can influence the procurement of materials/services related to bargaining power, subtitles, competition and barriers. The four parameters are selected as representatives for the company as shown in table 2 which rate (scale 0 to 5) for each risk criterion (bargaining power, substitution, competition and barriers) and divided by four.

**Table 2. Procurement risk**

| Procurement Risk (Scale 0-5) |
|-----------------------------|
| **Bargaining Power**         | **Buyer** | **Seller** |
|                             | 0 | 1 | 2 | 3 | 4 | 5 |
| **Substitution**             | **Easy** | **Difficult** |
|                             | 0 | 1 | 2 | 3 | 4 | 5 |
| **Rivalry**                  | **Intense** | **Mild** |
|                             | 0 | 1 | 2 | 3 | 4 | 5 |
| **Barriers**                 | **Weak** | **Strong** |
|                             | 0 | 1 | 2 | 3 | 4 | 5 |

| SUM/4 = Risk Index |

Step 3: Prioritize the criteria. Once the selection is complete, the criteria must be prioritized, consisting of the determination of weights for each of the previously selected criteria to compare those relatively important in the Supplier portfolio analysis.

Step 4: Supplier Portfolio Analysis. After selection criteria and priority determination, the purchasing manager gains impact position and risk criteria on their scale with consideration of each supplier.

Step 5: The construction of the Kraljic matrix. Finally, for each supplier, two scores are calculated, one for the impact of profit and one for the risk of supply. With this value, it is possible to enter the Kraljic matrix, position the supplier in the cell.
2.4. Lead time and cost analysis

Lead time has an important role in the economic and financial evaluation of the concept of production. It can be defined as measured time from when the Procurement Division receives a procurement proposal until the selected supplier submits it to the company. This includes the time required for planning, procurement, inspection, manufacturing, handling, picking, packing and shipping. Companies should know exactly when they will receive the products they need and suppliers should control the product time [13]. Reducing lead time means enabling greater competitiveness in the marketplace increases internal operation of production and distribution systems. Specifically, high lead time is associated with decreased customer satisfaction, which requires safer inventory to guarantee the required level of service [10]. The company's new business strategy aims to reduce the actual average waiting time in the procurement process from 60 to 45 days. This implies that procurement does not exceed 30 days after receiving the proposed procurement.

3. Results and discussion

The methodology describes the possibility of positioning in the Kraljic matrix of all suppliers belonging to the A, B and C classes of Pareto analysis. From the score obtained, two axis matrices ranging from 0 to 5. Figure 4 shows the purchase of portfolio analysis. The supplier position in Kraljic matrix itself should be adjusted to the interests of the company to have a specific relationship with the supplier. In this study, supplier positioning was evaluated in relation to critical lead times.

![Figure 4. Suppliers position in the Kraljic matrix, divided in the four quadrants](image)

The results of the matrix show 10.86 percent of leveraged suppliers, 47.73 percent of strategic suppliers, 25.56 percent of non-critical suppliers and 14.84 percent of congestion suppliers. The use of sections to divide paper text is optional and left as a decision for the author. Where the author wants to split the paper into the format section shown in table 1 and table 2 should be used.
3.1. Specific Spare part supply chain
The first problem is the supply chain of certain spare parts that determines the purchase time until it is delivered to the resulting unit which requires up to 180 days. From Kraljic Matrix, this supplier is in strategic quadrant for both the impact of profit and supply risk, because of the bargaining power of supplier monopoly. It is not possible for companies to store certain parts that are expensive but not used on a regular basis. For strategic needs using a partnership form approach. With a limited amount of material/service providers, specific types of materials/services, low price competition, can form a partnership with synchronized collaboration. Initiatives that can be developed are long-term agreements with the aim of leading leadership time and costs. This function is continuously supplying so that the operational process (production) can continue to be more efficient. Customer's main satisfaction is operational performance. It is expected to maintain the speed and consistency of product delivery for the performance of the work at a more competitive price. The barriers to functional collaboration are organizational structures, which are conditions when relevant divisions have different objectives, with different types/methods, materials for each need for materials/services accordingly, the development of the model contracts for three months with a minimum contract period of one year with a centralization scheme, which is the procurement process done at the center.

3.2. Repair critical equipment supply chain
The second critical path is the improvement of supply chain critical equipment parts that require raw materials. This need is characterized by one of the largest values of purchasing company. The waiting time outside procurement time of procurement process is 90 days. The critical aspect is the investment value and the risk that must be borne by the company and the suppliers appointed when the power plant does not achieve the specified performance. For strategic needs using a partnership approach with a limited number of materials/service providers, initiatives that can be developed are partnerships. The main customer satisfaction is the reliability of the service, a factor to improve the reliability of procurement processes. Barriers to collaboration are the limits of knowledge and sharing of information where knowledge and information sharing has not been established between suppliers and companies. The period of collaborative development for one provider for a minimum of 1 year with the company scheme does not have all the competencies and supporting equipment for repair work with the workshop scale, so that the company also has a dependence on the capabilities and availability of the workshop. Share the necessary knowledge and competencies with suppliers who have workshops (specific qualifications) by investing together in R&D (reengineering, reverse engineering) or tools. Table 3 summarizes the classification of the suppliers involved and some possible strategies for the reduction of lead time.

| Supply chain quadrant | Critical lead time (days) | Possible strategies                                      |
|-----------------------|---------------------------|---------------------------------------------------------|
| Strategic             | 90-180                    | Long-term agreement, partnership                         |
| Leverage              | 30-90                     | Long-term agreement, substitute                         |
| Bottleneck            | 30-90                     | Long-term agreement, re-source to new supplier          |
| Noncritical           | 30-60                     | Long-term agreement, digitalization, rationalization of supply based |

4. Conclusions
In this paper, the analysis of the purchase portfolio, based on the Kraljic Matrix, was applied to PT PJB Services. The result is a systematic and flexible model for classifying needs and suppliers and for identifying some critical relationships. This Model can be used for a variety of purposes, such as monitoring supplier relationships when the company's business strategy changes. In this paper, models are applied to identify the supply chain which is very important to respond to the company's needs with lead time reduction and its consequences to develop new business opportunities. The existence of
this model can identify the nature of supplier relationships—buyers and criteria influencing providing several potential solutions to further exploit the company's resources.

This model can be continuously developed because it is simple and practical so that it can be easily implemented by practitioners or companies in other sectors. In the future, studies may consider adding other risk criteria such as supplier risk (amount, availability, financial condition), technological level, competition, ease of storage, quantitative and qualitative flexibility and exclusivity. As for-profit impact criteria can consider the criteria for aspects of purchasing volume, impact on business growth, impact on profitability and the importance of purchasing. For each of these criteria, the analysis that is considered the most important and insignificant of the procurement items can be done so that the standardization characteristic of procurement goods can be standardized to avoid any differences between stakeholders.

References
[1] Zhang C, Gunasekaran A, and Wang W Y C 2015 A comprehensive model for supply chain integration Benchmarking 22 1141 - 1157
[2] Weele A J van 2010 Purchasing and Supply Chain Management (5th ed, London: Cengage Learning)
[3] Araujo L, Gadde L-E and Dubois A 2016 Purchasing and supply management and the role of supplier interfaces IMP 10 Iss 1 pp
[4] Suliantoro H N S and Juanita F 2014 Industrial Engineering National Conference (IENACO) 335–44
[5] Park J, Shin K, Chang T 2010 Industrial Management & Data System, Emerald insight 110 495–515
[6] Genis-Gruber A and Öğüt H 2014 Environmental Factors Affecting Innovation Strategies of Companies: Customers and Suppliers Effect Procedia - Soc. Behav 150 718 – 725
[7] Petersen K J, Handfield R B and Ragatz G L 2005 Supplier integration into new product development: Coordinating product, process and supply chain design J. Oper. Manag. 23 371–388
[8] Jaipuria S and Mahapatra S S 2015 Performance improvement of manufacturing supply chain using back-up supply strategy Benchmarking 22 Iss 3 446 - 464
[9] Andersen P H, Ellegaard C and Kragh H 2016 I’m your man: How suppliers gain strategic status in buying companies J. Purch. Supply Manag
[10] Bianchini A, Benci A, Pellegrini M and Rossi 2019 Supply chain redesign for lead time reduction through Kraljic purchasing portfolio and AHP integration Benchmarking 26 1194-1209
[11] Cox A 2015 Sourcing portfolio analysis and power positioning: towards a ‘paradigm shift’ in category management and strategic sourcing Supply Chain Manag. 20
[12] Caridi M, Crippa L, Perego A, Sianesi A and Tumino A 2010 Measuring visibility to improve supply chain performance: A quantitative approach Benchmarking 17 593-615
[13] Kristoffersen S 2015 Lead time reduction in an interactive value chain: Call-request-respond time reduction using a distributed information space IFAC 48-3 1276-83