

Supplier Selection of Technical Goods Using AHP Methods

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Abstract

Supplier selection becomes an important factor in the supply chain in a company. Basically, the supplier selection process is choosing the best supplier alternative among other suppliers. By choosing the right supplier will provide added value for the company than the competitor company, because the needs of the company are met well. Companies with good supplier selection and evaluation systems will influence the credibility of the selected suppliers. In this research, supplier selection process focused on supplier selection for spare part of technical goods. The criteria used for supplier selection not only consider quantitative and qualitative factors, but also subjective and objective factors. This factor is used to help the procurement department overcome the problems that have been faced, namely the uncertainty of inventory of goods from suppliers. Analytic Hierarchy Process Method (AHP) is used to help decision makers choose the best suppliers among other suppliers. Based on the results of tests conducted, AHP method can perform a fairly good calculation in choosing the best supplier alternative.

Keywords

Supplier selection, Supplier of technical goods, Analytic Hierarchy Process.

1. Introduction

Today, industry competition is very tight with many new companies emerging and growing consumer demands. According to Kilincci & Onal (2011), SCM (Supply Chain Management) is a process for integrating material procurement activities, converting materials into semi-finished goods and finished goods, to delivering finished goods to consumers. One of the most important SCM processes is procurement.

Procurement is the process of obtaining goods or services that are useful to ensure the smoothness of production and logistics processes in a company. The procurement process is a vital process in SCM because it is the spearhead of the whole process. The purpose of procurement activities is to help identify products and services that can be obtained externally. In addition, other objectives of the procurement activities are to develop, evaluate, and determine the best supplier, price, quality and delivery for the goods or services. In conducting the procurement process, very often the problem occurs in supplier selection activities. This is because the supplier selection process spends a lot of time and resources on collecting data and conducting careful analysis of the various positive and negative factors that will affect all decision alternatives (Avila et al., 2012). Therefore, methods that can be used to assist the supplier selection process are needed. Supplier selection needs to take into account many criteria, therefore the supplier evaluation process requires a multi-criteria approach in the analysis and solution search (Buyukozkan & Cifci, 2011).

There are 2 (two) common methods in decision making are decision-making with independent criteria and criteria dependent (Saaty, 2008). Analytical Hierarchy Process (AHP) method can be used for problems with independent criteria, while for problems with dependent criteria, Saaty (1999) uses ANP method. The AHP and ANP methods perform pairwise comparisons of each data to be assessed and thus require the participation of selected respondents to make comparisons.

In this research, supplier selection is done to know the best supplier that will be chosen to supply spare part or technical goods by using AHP method. AHP is a decision-making method developed to prioritize several alternatives when several criteria must be considered, and allow decision makers to construct complex problems into a hierarchical or integrated set of levels (Rahmayanti, 2010). Essentially, AHP is a method used to solve complex and unstructured problems into its groups, by organizing the group into a hierarchy, then entering numerical values instead of human perceptions of relative comparison. With a synthesis it will be able to determine which element has the highest priority. In the selection of suppliers for raw materials of production, companies mostly only take a certain time to choose the supplier, and continue cooperation so that suppliers supply raw materials for the company within a certain period. Different treatment is needed in the selection of technical goods suppliers because there are several types of goods that are only available when ordered, so it takes time to get them. In addition, many companies see from which side they need the item, whether for stock in the warehouse, or even to be used directly on the company's operations.

Therefore, in the selection of suppliers for technical goods, decision makers are not only influenced by the procurement department only, but also by the technical part which is the user, because it better understand the goods needed and the level of importance. There are many criteria required in the selection of technical goods suppliers, but only five main criteria are chosen because they are considered to represent everything, ie cost, quality, quantity, delivery, and service. From the procurement side, cost is the main criterion in choosing suppliers, as they are required to perform cost efficiency. But it will be different from the technical part or user, because they prefer the quality to facilitate their work and facilitate the company's production process. In addition, delivery criteria will be the most important criteria if the goods are urgently needed to be used directly, and there is no spare part stock in the warehouse.

2. Theoretical Basis

2.1 AHP (Analytic Hierarchy Process)

Analytical Hierarchy Process (AHP) was developed by Thomas L. Saaty. AHP is a decision-making method by performing pairwise comparisons between selection criteria as well as pairwise comparison between options. Tightening of decisions with AHP is generally composed into criteria, and alternative options.

1. AHP function

AHP is widely used for decision making in solving problems in terms of planning, alternative determination, prioritization, policy selection, resource allocation, needs determination, results forecasting, outcome planning, system planning, performance measurement, optimization, and conflict resolution.

2. The Principle of AHP

a. Decomposition

In this stage the complex structure of the problem is divided into sections within a hierarchy. The goal is to define from the general to the special. In its simplest form the structure serves as a means to compare between objectives, criteria and alternative levels. Each alternative set allows to be further divided into more detailed levels, including more criteria. The top level of the hierarchy is the goal of problem solving and there is only one element. The next level may have some elements as criteria, in which each of these elements can be compared against one another, has interests that are either almost identical or do not have too much difference in each element. If the difference is too great must be made a new level.

b. Comparative judgments

In this stage there will be a pairwise comparison of all elements present in the hierarchy with the aim of producing a relative importance scale of each element. Assessment will produce a scoring scale in the form of numbers. Pairwise comparisons in matrix form when combined will produce a priority.

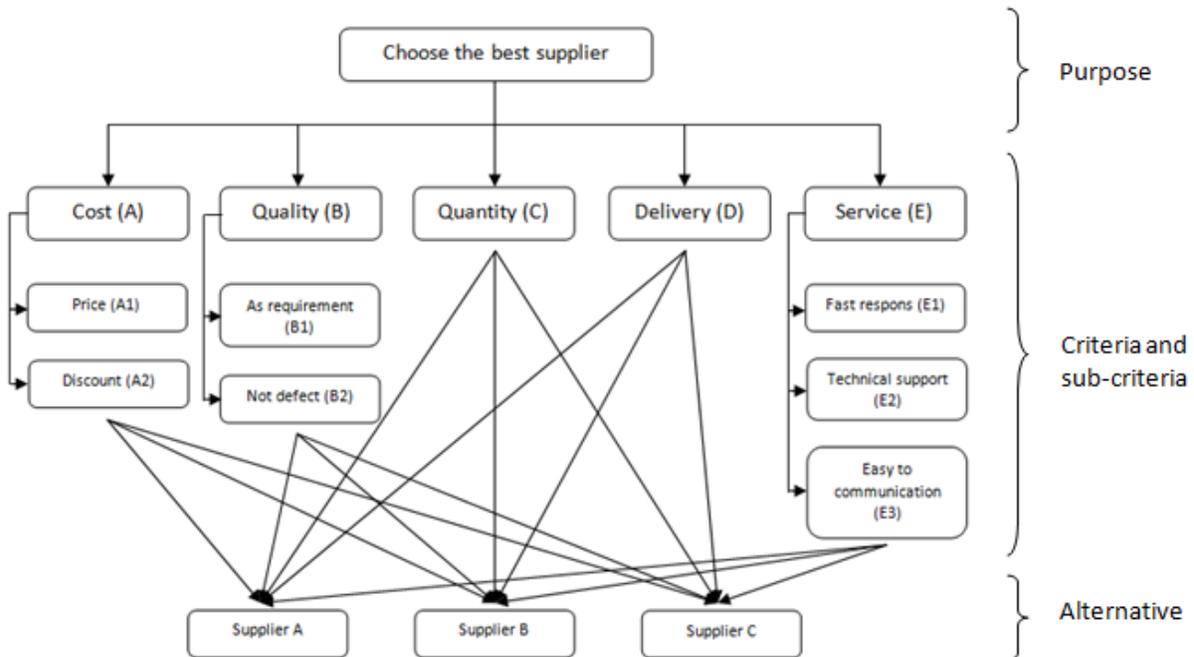
c. Priority Synthesis

Priority synthesis is derived from the multiplication of local priorities with the priority of the relevant criteria at the top level and add them to each element in the level affected by the criteria. The result is a combination or better known as a global priority term which can then be used to assign the local priority weighting of the existing element at the lowest level in the hierarchy according to the criteria.

3. Steps to use AHP

According to Nydick and Hill (1992), the supplier selection stages using the AHP method are as follows:

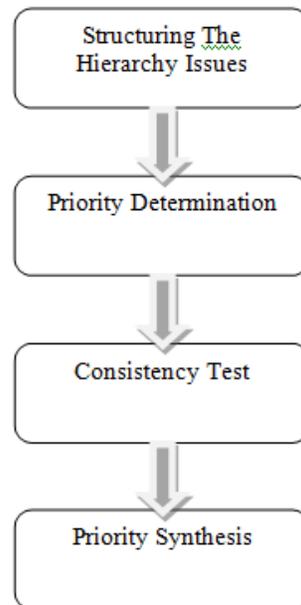
1. Identify the criteria to be used in supplier selection.
2. Make a pairwise comparison of the relative importance of the criteria to the goal, and calculate the priority or weighting criteria based on the information obtained.
3. Measure / assess suppliers in meeting the criteria.
4. Use the information in step 3, then make a comparison of the relative importance of the supplier / supplier against the criteria, and calculate the priority.
5. Use the results in steps 2 and 4, then calculate the priority or the weight of the supplier for the purpose of the hierarchy.



Picture 1. Structure of AHP Hierarchy

3. Methodology

This research is case study design (case study design). The object under study is the decision-making process in determining the supplier of technical goods to be selected to supply the company's needs. The source data obtained comes from questionnaires filled by the procurement department and technical section. The criteria used in this questionnaire were selected based on literature studies in other studies. As for the method used to determine the best supplier alternative is AHP method.



Picture 2. Steps to use AHP

The following criteria are considered in the selection of technical goods suppliers.

- Cost: In almost all cases, cost is the main priority that buyers should consider in choosing a supplier. There are several factors that affect the cost, but the main indicator in determining the cost is the price of the goods, and the discount provided by the supplier.
- Quality: of course the quality of the purchased goods needs to be considered as a criterion in the selection of suppliers, so that goods can function in accordance with customer needs. Sub criteria as per the requirements and not defects, is necessary to support the supplier selection process.
- Quantity: the quantity of goods that can be delivered by the supplier must be in accordance with the number of customer needs. Lack of delivery of goods involving certain processes in the company to be disturbed, unless the goods are used for stock in the warehouse, so it is not directly used and not needed immediately by the customer.
- Delivery: almost all customers want the supplier to deliver the goods on time or even earlier than the estimated time of the offer. The main purpose is that certain processes in the company are not disturbed, so the delivery criteria also need to be considered as the main criterion in supplier selection.
- Service: service is one of the most important criteria in supplier selection for technical goods. In contrast to raw material products, for technical goods sometimes required technical assistance support from suppliers to help solve the problem about the goods purchased.

4. Analysis and Discussion

To get the best supplier alternative, pairwise comparison is done by comparing each element with other elements. This pairwise comparison data is obtained from questionnaires filled by the procurement department and technical section. This is done to determine whether there is a difference between the best alternative and the criteria that are important in the selection of raw materials and technical goods.

From the results of data processing has been a done then obtained table final calculation result from AHP as in the following table. From the calculation of the value of each supplier that existed above shows that there is no significant difference in value obtained between suppliers with each other. This is because the assessment given by the Decision Maker when conducting the interview has a subjective nature and is a one-sided decision. It can be seen from the weighting which is where the Decision Maker is more concerned with the quality criteria than the other four criteria ie cost, quantity, delivery, and service. And even the cost is considered not so important because the standard price of each supplier is relatively the same. Since most engineering goods have a make to order production system it is clear that Decision Makers should also consider prioritizing delivery criteria to assist the company's production process. So in this case the company does not experience delays in producing goods ordered by consumers due to engine damage and unavailability of spare parts for repair.

Table 1. Global Priority

Purpose	Criteria	Sub Criteria	Weight	Alternative	Weight
Choose the best supplier	Cost (0.28007)	A1	0.17718139	Supplier A	0.106883
				Supplier B	0.035137
				Supplier C	0.035162
		A2	0.10288772	Supplier A	0.033071
				Supplier B	0.016
				Supplier C	0.053816
	Quality (0.47763)	B1	0.16011381	Supplier A	0.034265
				Supplier B	0.053076
				Supplier C	0.072773
		B2	0.31751579	Supplier A	0.072641
				Supplier B	0.14813
				Supplier C	0.096745
	Quantity (0.09310)			Supplier A	0.027042
				Supplier B	0.056192
				Supplier C	0.009867
	Delivery (0.07465)			Supplier A	0.021683
				Supplier B	0.045056
				Supplier C	0.007911
	Service (0.07455)	E1	0.02702624	Supplier A	0.00785
				Supplier B	0.016312
				Supplier C	0.002864
E2		0.00888475	Supplier A	0.002581	
			Supplier B	0.005362	
			Supplier C	0.000942	
E3		0.03864066	Supplier A	0.011223	
			Supplier B	0.023322	
			Supplier C	0.004095	

Table 2. Overall alternative weight

Alternative	Weight	Priority
Supplier A	0.3172	2
Supplier B	0.3986	1
Supplier C	0.2842	3

5. Conclusion

Based on the processing and data analysis that has been done in the previous section then the conclusion that can be taken is to determine supplier B as the best supplier. It can be known with the highest end value in the final calculation of AHP is the value of 0.3986. The next priority is supplier A with a weight value of 0.3172 and the last priority is supplier C with a weight value of 0.2842.

For further research, researchers can use other criteria that are in accordance with the policy by considering the case at hand. In addition, to reduce the subjective subjectivity of respondents, especially to reduce the uncertainty of respondents in mapping their perceptions into numerical numbers, researchers can use the AHP fuzzy method.

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Biographies

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