

SELECTION OF RAW MATERIAL SUPPLIERS USING ANALYTICAL HIERARCHY PROCESS IN FOOD AND BEVERAGE COMPANY, SOUTH JAKARTA

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Abstract - The purpose of this research was to see the selection of raw material suppliers as an assessment of supplier performance. Data were obtained from the results of assessment of the experts in food and beverage company in South Jakarta. The rate selection of suppliers was based on several criteria. There was the suitability in some products with the demand for tolerance of 10% about mismatch delivery, 10% of the accuracy of the product delivery, 5% of products quality, 5% of product prices, 5% of the easiness of information or data, and 10% of the problem-solving action. The results show that 40% of suppliers get a warning letter regarding their performance from January to June 2016, 20% of suppliers have already gotten a reprimand directly from the company, 20% of suppliers have been deactivated from the list of suppliers, because they cannot meet the target value which equals to 4,05, only 20% of the supplier can maintain its performance.

Keywords: Analytical Hierarchy Process, selection criteria, raw material supplier

I. INTRODUCTION

The increasing development of current food and beverage industry requires entrepreneurs in this industry to innovate and develop new systems with a target of fulfilling the needs and desires of customers. According to the Ministry of Industry of the Republic of Indonesia (2016), in the first quarter of 2016, growth in the food and beverage industry has reached 7,55 percent or higher compared to the period in 2015 which was 7,54 percent. In fact, the performance of the food and beverage industry outpaced the growth of non-oil industry in the first quarter of 2016 about 4,46 percent. This shows that the performance of the food and beverage industry in the country has a positive achievement by providing a large contribution to the Indonesian economy. Amelia *et al.* (2012) explained that the food and beverage industry subsector was a part of the manufacturing sector. In addition to providing a great contribution to the economic development, this sector also has a great contribution in employment.

The contribution to economic development in the manufacturing sector in four consecutive years from 2005 to 2008 is 12,4%, 14%, 14,5, and 15,4%. This is a challenge for the entrepreneurs in the food industry to pay more attention to the quality of the materials used and the price offered to compete to be the best for customers. An important thing to support the company's performance is the right supplier

selections. Supplier as a provider of material should meet the qualifications to improve the company competitiveness. Food and beverage company in South Jakarta is one of the companies participating in the development of food and beverage industry. This company is a large company with 1200 employees.

Food and beverage company in South Jakarta has several suppliers regarding the raw material of Japanese food. It is managed by multiple criteria including the suitability of the amount of product demanded, punctual delivery of products, product quality, product prices, easiness of information/data, and problem-solving. However, through the observation, discussions, interviews, and direct observation, the researchers find that there are often problems like rejection of their goods, the unmatched number of the products with the order, the delay in the delivery of raw materials, the slow response in dealing with complaints from the customers, and the absence of expired date, Purchase on Date (POD), and halal certificate on the product. The initial way to maintain the quality of the product is selecting the competent supplier. Supplier selection needs to be done to get a supplier that really can meet the needs of companies consistently and qualifiedly. Moreover, the steps used in the selection of suppliers are using one of the Analytic Hierarchy Process (AHP) methods.

AHP is developed by a mathematician, Thomas L. Saaty. This method is a framework to take decisions effectively on complex problems by simplifying and accelerating the decision-making process. It is dividing the problem into parts, arranging parts or these variables in a hierarchical arrangement, giving a numerical value as the consideration of the subjective importance of each variable, synthesizing these considerations to set the variables which have the highest priority, and doing it for the outcome of the situation. Saaty and Peniwati (2008) explained that the AHP was one method that could be used in determining the decisions. The result of AHP process was the priorities of the alternatives. These priorities can be used to determine the best alternative.

AHP is one of the tools used in decision-making by Adhi (2010). He concluded that the decision was a choice of strategy of an action. Then, decision-making is a form of management activity by selecting actions from some alternatives that have been previously formulated to solve a problem or a conflict in management. According to Turban *et al.* (2011), the output of the AHP process might be used as a tool to support decision making. AHP is a precise method for solving complex problems. In AHP, an issue is resolved within an organized framework so that it can make effective

decisions. In short, the complex problem can be simple in the decision-making process.

Moreover, Taufik *et al.* (2014) stated that the application of the selection of raw material supplier was based on ready mix integration of AHP and Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS). From this research, it could be concluded that after calculating the performance of suppliers using the method of AHP and TOPSIS, the suppliers of raw materials in Merak Jaya Concrete with the best performance was CV Makmur Jaya Abadi for sand, PT Royal Inti Mandiri Abadi with the product, Semen Tiga Roda, Merak Jaya CV for stone, and PT BASS or PT BASF for chemical concrete.

Then, Putri (2012) stated that the supplier selection by using a model of Quality, Quantity, Cost, and Delivery (QQCD) produced four Supplier Performance Indicators (SPI). Criteria quality had the highest weight. It was followed by delivery quantity, while the last was the cost or price.

Similarly, Probowati (2013) showed that the supplier selection would determine the price of each product on the retail business. The retail business included business related to the sale of goods and services provided directly to the consumer. This business was an intermediary for a business of producers and consumers.

On contrast, Nurhasanah and Tamam (2011) stated that there was no significant difference in the selection of the best supplier by using Analytical Hierarchy Process (AHP) and Fuzzy Analytical Hierarchy Process (Fuzzy AHP). Thus, the process of selecting the best suppliers can use one of two methods. In addition, Puspitasari (2016) added that the ANP method was a method that was able to represent the level of interest of various parties by considering the interdependence of criteria and sub-criteria. The application of this method had been applied to the PT Kimia Farma Plant Semarang in selecting the best suppliers. It found that the quality of suppliers was the highest criteria that should be considered in choosing the supplier. Meanwhile, the other criteria were the environment of the supplier, suppliers' shipping, suppliers' service, suppliers' relationships and communication with consumers.

Meanwhile, Kurniawati *et al.* (2013) stated that the criteria influencing supplier selection were the best performance of supplier in the past, price, communication systems, and the professionalism. The other important criteria considered in choosing suppliers were order delivery time, consistency of product quality, price, and the ability of suppliers to fulfill the deliveries. The supplier selection based on proper criteria in accordance with the needs in the period of interest and effectiveness was going to gradually reduce production costs, and increase productivity and customer satisfaction. The criteria of evaluation regarding the best supplier had to be reliable in continuity.

Viarani and Zadry (2016) stated that the new plant of Indarung VI Project by PT Semen Padang did planning, and the selection of goods and services to fulfill the needs as the best supplier which was capable of providing good quality of goods and services. Then, AHP was a systematic method and did not require a long time to show the priority weight of criteria and the best suppliers.

Similarly, Iriani and Herawan (2012) explained that the ANP method was able to fix the weaknesses of AHP. ANP method accommodated the linkages or alternative criteria. For linkage to the ANP method, there were two types of linkages. They were in a set of elements (inner dependence), and between the different elements (outer

dependence). The existence of these linkages caused ANP method to be more complex than AHP. The results of the research found an alternative supplier who would supply the raw material (yarn) in Nedy Home Industry.

Moreover, there is research by Merry *et al.* (2014) concerning of supplier selections with AHP and TOPSIS. It was a case study on retail companies. The researchers concluded that AHP and TOPSIS could help PT Hero Supermarket Tbk in selecting fruit suppliers according to key criteria and other criteria that could be a consideration in determining the supplier.

The recent research is by Ngatawai and Setyaningsih (2011). The researchers concluded that based on the data processing and analysis that had been done, the supplier "A" was the best supplier. It was because their values in the final calculation of AHP was high with a value of 0,240.

Darmanto *et al.* (2012) defined the problem, determined the desired solution, and created a hierarchical structure begun with a common goal. It was followed by criteria and alternatives to make a selection after comparison of the matrix illustrating the relative contribution or influence of each element compared to the objectives and criteria was above it. The comparison was based on the selection of decision makers to judge the importance of the elements after it normalized the data by dividing the value of each element in the matrix paired with a total value of each column and calculating eigenvalues vector tested for consistency. If it were not consistent, the data retrieval (preferences) would be repeated. Eigenvalues vector was the maximum value obtained in eigenvector. After the calculations repeated the step 3, 4 and 5 for all levels of hierarchy, the calculation of eigenvector was for each pairwise comparison matrix. Eigenvalues vector was the weight of each element. Then, the last test was the consistency hierarchy.

II. METHODS

According to Sugiyono (2011), quantitative research is obtaining data in the form of numbers or qualitative data numbering. There are several steps in conducting this research. The first step is a preliminary survey of the condition and situation of the problem contained in the company. In addition, the researchers also study the literature relating to the issues examined like a concept of Supply Chain Management (SCM), procurement management, and others which are used for future data processing. The second step is to identify emerging issues in the research object. The third step is the formulation of the problem. After identifying the problem, the researchers formulate the issue about the focus of discussion in this research. The fourth step is determining the research purposes by considering the problem formulation before. The fifth step is data collection by collecting primary and secondary data. Primary data is obtained from the questionnaire by respondents according to the needs of secondary data, the condition of supplier owned by enterprise or supporting data to strengthen the weighting and justification of the questionnaire. The sixth step is a data processor. The data processing is to define existing problems and lower it into the assessment criteria. Each criterion is given a classification assessment with a value between 5-9. The value 5 is the lowest value, and the value 9 is the highest value. Moreover, the coverage is determined by the weight of the company as a target in the process of assessment to the final calculation of available supplier selection. Currently, the company does not have a standard of supplier selection. From interviews with the

manager of purchasing, the researchers generate the value of decisions. Value collected from each of the assessment criteria is multiplied by the weight (target value), then the total value is used as a measure for the company's decision to the supplier. The last step is to perform the analysis and discussion. In this stage, it is to analyze the data processing that has been conducted in the previous stage. In this stage, the high accuracy is needed to avoid mistakes in reading the data. Then, the analysis and discussion of data processing are conducted.

III. RESULTS AND DISCUSSIONS

The raw material purchasing process conducted in food and beverage company in South Jakarta begins with knowing the needs of raw material in the outlet and sending the form of a request to the purchasing department in accordance with the needs. The purchasing department inputs the request into a system in the form of purchase orders that will be sent to the supplier. Purchasing department also compares the price before selecting the preferred suppliers if the ordered item has more than one supplier. After purchasing department gives the order to suppliers, it must ensure that Purchasing Order (PO) has been received by the supplier and the item must be sent to the right outlet. If there are problems in the process of delivery to the outlet, the supplier must inform the purchasing department to inform about the delivery problem. Moreover, the outlet should also inform about the arrival of the goods to the purchasing department. If the item sent does not fit, the outlet must reject the goods and inform the purchasing department. Then, purchasing department will find the solutions.

The object of this research is the evaluation of suppliers conducted by food and beverage company in South Jakarta twice a year (January to June and July to December). If the supplier gets a reprimand directly with a warning letter from the purchasing department, the supplier will be evaluated in the second period. Moreover, if there is no better change, the supplier will be taken out from the list of suppliers in food and beverage company in South Jakarta. Table 1 shows the list of suppliers in food and beverage company in South Jakarta.

Table 1 The Supplier in Food and Beverage Company in South Jakarta

Supplier Code	Supplier Name
S1	KWR
S2	BDO
S3	ECR
S4	NWL
S5	TWF
S6	SMX
S7	NMK
S8	MUA
S9	LCS
S10	AJS

The criteria used by food and beverage company in South Jakarta are the suitability of the number of products shipped from the supplier. This assesses the performance of suppliers regarding order fulfillment based on the demand. The other criterion is the accuracy of delivery from suppliers. It will assess the suppliers' accuracy regarding delivery in accordance with the schedule determined by the

purchasing department. Next, there is also product quality. This criterion compares the conformity of the specifications expected by the food and beverage company in South Jakarta and supplier. Next, the price is about the price of the same item with a different supplier. In addition, there is easiness in obtaining information such as the composition of the product, the specification of the product, flow process, halal certificate, the expiration date, production code, and the distributors. Last, it is about problem-solving. This is related to the reliability of suppliers in solving the problems arisen during the transaction of purchase and delivery. The stages of the determination of the weight of each criterion are shown in Table 2.

The weights are determined by the company as a target in the process of assessment in the final calculation of selection of the available supplier. The range of values or weights is shown in Table 3.

Next, currently, the company does not have a standard supplier reception. From interviews with the manager of purchasing, and by generating design decisions, it can see the range of the suppliers' rank. Table 4 shows the range.

The supplier will be the best supplier if the supplier has the credibility and the level of mismatch in criteria assessed by 5% of the target company. The decision to maintain the suppliers' existence in this company is if the supplier can meet 10% of tolerance of the inconsistency in the criteria assessed. However, if the supplier makes 20% of the deviation of inconsistency in the criteria, the supplier will get a warning letter from the company. If the supplier has 35% of mismatch deviation of the target value, the purchasing staff will ask for corrective action from supplier. If in 3 times of the evaluation, the supplies does not show improvement, then the goods or services supplied will be discontinued. The supplier will be excluded from the list of suppliers in food and beverage company in South Jakarta if the supplier repeats the same mistake during the period of the warning. Table 5 shows the results of the calculation of the supplier's performance regarding supplier S1 and S2.

From the calculation in Table 5, it can be concluded that the supplier S1 and S2 will get a warning directly from the company for its performance. Moreover, the result of supplier S3 and S4 is in Table 6.

From the calculation in Table 6, it can be seen that supplier S3 is taken out as a supplier in food and beverage company in South Jakarta. It is because the calculation is below the value of the company. Meanwhile, supplier S4 receives a warning letter. It has a decline in the performance. Moreover, the warning letter serves as a consideration in the company's next monitoring of the supplier ratings. Then, Table 7 shows the result of S5, S6, and S7.

Table 7 describes that the food and beverage company in South Jakarta will holds supplier S5 because the supplier has a good performance and can work well with the company. On the contrary, supplier S6 is be taken out as a supplier because it cannot fulfill the target value of the company. Meanwhile, supplier S7 gets a warning letter as it has a decline in the performance. The warning letter is also for consideration in the company's next monitoring of the supplier ratings. Next, the results of supplier S8, S9, and S10 are in Table 8.

Table 8, concludes that the food and beverage company in South Jakarta holds supplier S8 because it has a good performance and can work well with the company. However, supplier S9 and S10 receive a warning letter as it has a decline in the performance. The warning letter is the consideration for company in next monitoring.

Table 2 Range of Qualification Values

No	Criteria	Appraisal	Range of Values
1	Suitability of Product Numbers	0%-5% of mismatches of the number of products shipped	9
		6%-15% of mismatches of the number of products shipped	8
		16%-25% of mismatches of the number of products shipped	7
		26%-35% of mismatches of the number of products shipped	6
		> 36% of mismatches of the number of products shipped	5
2	Precision of Delivery	0%-5% of delays in product delivery	9
		6%-15% of delays in product delivery	8
		16%-25% of delays in product delivery	7
		26%-35% of delays in product delivery	6
		> 36% of delays in product delivery	5
3	Quality	0%-5% of tolerance regarding suitability of products shipped during the selection period	9
		6%-15% of tolerance regarding suitability of products shipped during the selection period	8
		16%-25% of tolerance regarding suitability of products shipped during the selection period	7
		26%-35% of tolerance regarding suitability of products shipped during the selection period	6
		> 36% of tolerance regarding suitability of products shipped during the selection period	5
4	Price	very competitive	9
		competitive	8
		Competitive enough	7
		Not Competitive	6
		Bad Competitive	5
5	Easiness in Information Data	Very Easy	9
		Easy	8
		Easy Enough	7
		Not Easy	6
		Difficult	5
6	Problem Solving	Very Fast Response	9
		Perceptive	8
		Quite Response	7
		No Response	6
		Indifferent	5

Table 3 The Range of Weight

No	Criteria	Company Policy	Target
1	Suitability of Product Numbers	10%	0,9
2	Precision of Delivery	10%	0,9
3	Quality	5%	0,45
4	Price	5%	0,45
5	Easiness in Information Data	5%	0,45
6	Problem Solving	10%	0,9
Total			4,05

Table 4 The Range of Value

Number	Range of Value	Result
1	4,00-4,05 of Total Value	Best Supplier
2	3,80-3,99 of Total Value	Hold Supplier
3	3,59-3,79 of Total Value	Treatment
4	3,23-3,58 of Total Value	Warning
5	< 3,22 of Total Value	be taken out

Table 5 The Result of S1 and S2

No	Criteria	Vendor					
		S1 (a)	Weight (b)	Total (axb)	S2 (a)	Weight (b)	Total (axb)
1	Suitability of Product Numbers	9	10%	0,9	9	10%	0,9
2	Precision of Delivery	9	10%	0,9	7	10%	0,7
3	Quality	9	5%	0,45	8	5%	0,4
4	Price	8	5%	0,4	9	5%	0,45
5	Easiness in Information Data	7	5%	0,35	7	5%	0,35
6	Problem Solving	7	10%	0,7	8	10%	0,8
Grand Total		3,7			3,6		
Result		Treatment			Treatment		

Table 6 The Result of S3 and S4

No	Criteria	Vendor					
		S3 (a)	Weight (b)	Total (axb)	S4 (a)	Weight (b)	Total (axb)
1	Suitability of Product Numbers	9	10%	0,9	8	10%	0,8
2	Precision of Delivery	6	10%	0,6	7	10%	0,7
3	Quality	7	5%	0,35	8	5%	0,4
4	Price	7	5%	0,35	8	5%	0,4
5	Easiness in Information Data	6	5%	0,3	6	5%	0,3
6	Problem Solving	6	10%	0,6	7	10%	0,7
Grand Total		3,1			3,3		
Result		Treatment			Treatment		

Table 7 The Result of S5, S6, and S7

No	Criteria	Vendor								
		S5 (a)	Weight (b)	Total (axb)	S6 (a)	Weight (b)	Total (axb)	S7 (a)	Weight (b)	Total (axb)
1	Suitability of Product Numbers	9	10%	0,9	8	10%	0,8	9	10%	0,9
2	Precision of Delivery	9	10%	0,9	7	10%	0,7	8	10%	0,8
3	Quality	8	5%	0,4	8	5%	0,4	7	5%	0,35
4	Price	7	5%	0,35	7	5%	0,35	6	5%	0,3
5	Easiness in Information Data	9	5%	0,45	6	5%	0,3	6	5%	0,3
6	Problem Solving	9	10%	0,9	6	10%	0,6	6	10%	0,6
Grand Total		3,9			3,15			3,25		
Result		Hold			Taken Out			Warning		

Table 8 The Result of S8, S9, and S10

No	Criteria	Vendor								
		S8 (a)	Weight (b)	Total (axb)	S9 (a)	Weight (b)	Total (axb)	S10 (a)	Weight (b)	Total (axb)
1	Suitability of Product Numbers	9	10%	0,9	8	10%	0,8	7	10%	0,7
2	Precision of Delivery	9	10%	0,9	7	10%	0,7	6	10%	0,6
3	Quality	9	5%	0,45	8	5%	0,4	7	5%	0,35
4	Price	9	5%	0,45	7	5%	0,35	6	5%	0,3
5	Easiness in Information Data	7	5%	0,35	6	5%	0,3	6	5%	0,3
6	Problem Solving	9	10%	0,9	7	10%	0,7	6	10%	0,6
Grand Total		3,95			3,25			2,85		
Result		Survive Supplier			Warning Letter			Warning Letter		

IV. CONCLUSIONS

Table 9 Summary of the Results of the Suppliers' Performance

No	Decision Making	Supplier	Percentage
1	Best Supplier	2	20,00%
2	Hold Supplier	2	20,00%
3	Treatment	4	40,00%
4	Warning	2	20,00%
Total		10	100,00%

There are several conclusions according to Table 9. First, 40% of suppliers in food and beverage company in South Jakarta get a warning letter about their the performance during January to June 2016. Second, 20% of suppliers already get a reprimand directly from food and beverage company in South Jakarta. Third, 20% of suppliers have been deactivated from the list of suppliers in food and beverage company in South Jakarta. It is because they cannot fulfill the target value of food and beverage company in South Jakarta which equals to 4,05. Last, only 20% of the suppliers can maintain its performance.

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