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HOLTEKAMP JAYAPURA BRIDGE CONSTRUCTION PROJECT: THE ANALYSIS OF RAW MATERIAL SUPPLIERS' SELECTION

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Abstract

This research aims to determine the supplier priorities of company. This research aims to determine the supplier of broken stone raw material project priorities of PT. PP-HK JO. The data collection techniques are conducted with a interview and a questionnaire to 3 (three) expert respondents using a comparison scale of 1-9. There are 4 (four) criteria used in this reserach, namely price, quality, shipping speed and product capacity. And alternative suppliers in this reserach there are 8 (eight) suppliers. The method used is Analysis Hierarchy Process (AHP) using Expert Choice V.11 software. The results of the analysis using the Expert Choice showed that the price criteria in the first rank, the quality criteria in the second rank, the criteria for sending speed in the third rank, weight and product capacity criteria at number four. And it can be concluded that the best final ranking of suppliers in order to supply broken stone materials at the Holtekamp bridge construction project from the order of 1-8 is a supplier of Agung M, Sultan, SKB, Youtefa, Bumi Infrastruktur, Bintang M, Simpama Dwi, and Rajawali. And the results showed that 3 (three) best suppliers that can be chosen by the company are Agung M, Sultan, and SKB.

Keywords: AHP, Expert Choice, Pemasok, Proyek Pembangunan Jembatan

Abstrak

Penelitian ini bertujuan untuk menentukan pemasok prioritas sesuai kriteria pada perusahaan. Penelitian ini untuk menentukan pemasok bahan baku batu pecah prioritas perusahaan PT. PP-HK JO. Teknik pengambilan data dilakukan dengan wawancara dan kuesioner kepada 3 (tiga) responden ahli menggunakan skala perbandingan 1-9. Kriteria yang digunakan dalam penelitian ini ada 4 (empat) yaitu harga, mutu, kecepatan pengiriman dan kapasitas produk. Dan alternatif pemasok dalam penelitian ini ada 8 pemasok. Metode yang digunakan adalah Analisis Hierarki Process (AHP) menggunakan software Expert Choice V.11. Hasil analisis menggunakan Expert Choice menunjukkan bahwa kriteria harga berada di posisi pertama, kriteria mutu di peringkat kedua, kriteria kecepatan pengiriman di peringkat ketiga dan kriteria kapasitas produk di peringkat keempat. Dan dapat disimpulkan bahwa peringkat akhir terbaik pemasok secara berurutan yaitu untuk menyuplai material batu pecah pada Proyek Pembangunan Jalan Akses Jembatan dari urutan 1-8 adalah pemasok Agung M, Sultan, SKB, Youtefa, Bumi Infrastruktur, Bintang M, Simpama Dwi, dan Rajawali. Hasil Penelitian menunjukkan bahwa 3 (tiga) pemasok terbaik yang dapat dipilih perusahaan yaitu Agung M, Sultan, dan SKB.

Kata Kunci: *AHP, Expert Choice, Supplier, Bridge Construction Project*

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Introduction

One of the essential activities for a construction service provider company is the procurement of raw materials. The raw materials are closely related to suppliers, where a company obtains the raw materials needed for the production process from several suppliers. Thus, the supplier becomes an external party that has a vital role in ensuring the smooth production process (Andriana and Djatna, 2012). According to Andriana and Djatna (2012), inventory management influences all business functions, especially finance, operations, and marketing. The finance department wants low inventory levels, while the marketing and operations department wants inventory always to be there to meet consumer needs and production needs. When the supply cannot meet the existing demand, the company will experience losses.

The selection of effective suppliers can help companies achieve the desired production results. In order to keep raw material supplies optimal, it is necessary to pay attention to purchasing schedules, prices, quality of raw materials, and good cooperative relations with suppliers. In general, in the process of sending raw materials from suppliers, problems often occur, such as discrepancies between the agreed time for delivery of raw materials and the actual delivery time and the quality of raw materials from different suppliers. The quality of raw materials varies due to the fact that the number of suppliers is more than one supplier. For this reason, companies need to select suppliers to see the performance of suppliers so that it makes it easier to choose suppliers.

PT. Hutama Karya (HK) and PT. Housing Development (PP) is a construction service provider company in Indonesia. The construction of the Jayapura city holtekamp bridge access road was carried out by the two companies in the form of Joint Operation (JO) cooperation. Construction of the Holtekamp Bridge Access Road as the entrance to the Holtekamp Bridge, which is currently an icon in the province of Papua, to facilitate land transportation between Holtekamp and Hamadi. There is one issue for the construction of the access road to the Holtekamp bridge, namely backfilling and the foundation layer, where the foundation layer is divided into two, namely the class A foundation layer (LPA) and class B foundation layer (LPB).

For stockpiling LPA and LPB, raw materials are needed, namely stone. In procuring raw materials, the company cooperates with several suppliers. In supplying raw materials, problems often occur, including delivery delays, and several suppliers need help to fulfill the company's ordering capacity. Of course, this is detrimental to the company because it hinders the construction process. Delivery delays often occur due to weather constraints, unpredictable disasters, and lack of transportation for these raw materials. In the problem of order capacity, there is often the availability of materials or a need for raw materials ordered by the company because companies cannot fulfill their production capacity. So the company must choose more than one supplier to meet the needs of the LPA and LPB. The project manager said that because there are so many needs, of course, the company needs a minimum of 3 (three) suppliers to meet these needs because if there are only 1 (one) or 2 (two) suppliers, of course, it is very lacking. Raw materials cannot be fulfilled optimally.

Therefore, companies need to carry out supplier selection and the right decision-making process in selecting suppliers with the criteria set by the company. The method used in this study for decision-making is the Analytical Hierarchy Process (AHP).

The use of the AHP method offers several benefits. One crucial advantage is its simplicity. AHP can also accommodate uncertain and subjective information and logically follow experience, insight, and intuition. The advantage is developing the hierarchy itself. This forces buyers to seriously consider the criteria (Nydick and Hill, 1992). The AHP method is a systematic method that takes a short time and can show the priority weights and criteria for selected suppliers (Viarani and Zadry, 2015).

Researchers in various countries have conducted many studies on the AHP method in supplier selection. As done by Sangeetha and Anila (2016), researchers apply the AHP method combined with Topsis in selecting suppliers in the construction industry. Furthermore, Handayani and Darmianti (2017) also conducted a similar study. Researchers used the AHP method in selecting suppliers of building raw materials. Wardah (2013), researchers used the AHP method in the selection model for dry-grated coconut raw materials.

Based on the problems above, the researcher is interested in taking research on "Analysis of the selection of raw material suppliers in the Holtekamp Jayapura Bridge Access Road Development Project, PT. PP-HK, JO." The Holtekamp Jayapura Bridge construction project was chosen because the object of this research is in the process. Some suppliers are overwhelmed to meet the capacity of orders from the company, so the company must look for other material suppliers to fulfill the lacking material. This study aims to analyze and determine priority suppliers according to company criteria.

Method

The research to be carried out is action research or direct action research on the research object. According to Arikunto (2010:18), action research is research on things that happen in the community concerned. Quantitative data in the writing of this study include price data offered by suppliers and supplier product capacity. Qualitative data in this study include company profiles, organizational structure, and company supplier data. Data collection techniques were carried out by interviews and questionnaires to 3 (three) expert respondents using a comparison scale of 1-9 (Saaty, 1994). The scale of 1-9 is:

        Value 1 = equally important
        Value 3 = slightly more important
        Value 5 = more important
        Value 7 = much more important
        Value 9 = absolute more important
        Value 2,4,6,8 = median

There are 4 (four) criteria used in this study, namely price, quality, delivery speed, and production capacity. Moreover, alternative suppliers in this study are 8 (eight) suppliers. The method used is Hierarchical Process Analysis (AHP) using *Expert Choice V.11* software.

Supplier Selection

One of the main aspects of the supplier selection function for procuring required goods, services, and equipment is for all business enterprises. Purchasing itself is directly related to suppliers who provide materials or materials, both in the form of companies and individuals. A supplier is a company or individual providing the resources the company and its competitors need to produce certain goods and services. Every company, service, and manufacturing business can determine the number of suppliers needed to supply raw materials and supporting components in the conversion process. The decision to use several or a few suppliers depends on analyzing needs and costs for procuring the required raw materials/materials. Decisions to determine the number of suppliers will be discussed in detail by looking at the advantages and disadvantages of determining the number of suppliers used (Tampubolon, 2018: 217).

The main objective of the supplier selection process is to determine suppliers who efficiently meet the company's needs consistently and minimize the risks associated with procuring raw materials and components (Pradipta and Diana, 2017).

Analytical Hierarchy Process (AHP)

Thomas L. Saaty developed the Analytical Hierarchy Process (AHP) in the 1970s (Aliffangga, 2018). This method is a multi-criteria decision-making model that can help the human frame of mind where logic, experience, emotion, and sense are optimized into a systematic process.

Result and Discussion

Criteria and Alternatives Determination

Determination of criteria and alternatives is needed in analyzing the process hierarchy as the initial research stage. Based on the interviews conducted with the deputy and technical manager of the Holtekamp access road construction project, four (4) criteria were obtained: price, quality, speed of delivery, and production capacity. In order to meet the needs of crushed stone raw materials for foundation layer A and foundation layer B, PT. PP-HK, JO has 8 (eight) alternative suppliers, which will then be selected by 3 (three) leading suppliers.

Table 1. List of Supplier

No.	Supplier's Name
1	Rajawali
2	Agung M
3	Sultan
4	SKB
5	Bintang Mulia
6	Youtefa
7	Bumi Infrastruktur
8	Simpama Dwi

Source: Holtekamp Bridge Access Road

Development Project, 2019

Criteria Rating

Table 2. Criteria Rank

No	Criteria	Weight	Rating
1	Price	0.392	1
2	Quality	0.316	2
3	Delivery Speed	0.181	3
4	Production Capacity	0.111	4
Inconsistency = 0.06			

Source: data processed, 2019

The results of the Expert Choice analysis in the figure show that the price criterion is in the first position with a weight value of 0.392, the quality criteria is in the second rank with a weight value of 0.316, the delivery speed criterion is in the third position with a weight value of 0.181, and the product capacity criteria is in the fourth rank with a weight value of 0.111. The value of the consistency ratio (CR) in the comparison criteria is 0.06, which means it is consistent and acceptable because CR ≤ 0.1.

Supplier Rating Based on Price Criteria

Table 3. Supplier Rating Based on Price Criteria

No	Criteria	Weight	Rating
1	Rajawali	0.092	4
2	Agung M	0.187	2
3	Sultan	0.281	1
4	SKB	0.056	8
5	Bintang M	0.091	5
6	Youtefa	0.131	3
7	Bumi Infrastruktur	0.077	7
8	Simpama Dwi	0.086	6
Inconsistency = 0.04			

Source: data processed, 2019

The results of the Expert Choice analysis in the figure show that suppliers based on price criteria are ranked 1-8, meaning consistent and acceptable because CR ≤ 0.1. sequentially, namely: Sultan (0.281), Agung M (0.187), Youtefa (0.131), Rajawali (0.092), Bintang M (0.091), Simpama Dwi (0.86), Bumi Infrastructure (0.077), and SKB (0.056). This means that the suppliers of Sultan, Agung M, and Youtefa are in the top 3 (three) rankings in terms of offering prices for crushed stone raw materials that are the cheapest and in accordance with what the company needs. Meanwhile, Rajawali, Bintang M, Simpama Dwi, Bumi Infrastruktur, and SKB have higher bid prices. The consistency ratio (CR) in comparison criteria is 0.04, which is consistent and acceptable because CR≤0.1.

Supplier Rating Based on Quality Criteria

Table 4. Supplier Rating Based on Quality Criteria

No	Supplier	Weight	Rating
1	Rajawali	0.066	7
2	Agung M	0.345	1
3	Sultan	0.145	2
4	SKB	0.098	4
5	Bintang M	0.058	8
6	Youtefa	0.103	3
7	Bumi	0.091	6

No	Supplier	Weight	Rating
8	Infrastruktur Simpama Dwi	0.094	5
Inconsistency = 0.03			

Source: data processed, 2019

The results of the Expert Choice analysis in the figure show that suppliers based on price criteria are ranked 1-8 in a row, namely: Agung M (0.345), Sultan (0.145), Youtefa (0.103), SKB (0.098), Simpama Dwi (0.094), Infrastructure Earth (0.091), Rajawali (0.66), and Bintang M (0.058). That is, ratings 1-3 after the query trial process indicate that the material follows the quality of the specifications required by the company. The value of the consistency ratio (CR) in the comparison criteria is 0.03, which means it is consistent and acceptable because CR ≤ 0.1.

Supplier Rating Based on Delivery Speed Criteria

Table 5. Supplier Rating Based on Delivery Speed Criteria

No	Supplier	Weight	Rating
1	Rajawali	0.077	8
2	Agung M	0.275	1
3	Sultan	0.080	7
4	SKB	0.169	2
5	Bintang M	0.113	3
6	Youtefa	0.104	4
7	Bumi Infrastruktur	0.090	6
8	Simpama Dwi	0.093	5
Inconsistency = 0.04			

Source: data processed, 2019

The results of the Expert Choice analysis in the figure show that suppliers based on price criteria are ranked 1-8 in a row, namely: Agung M (0.275), SKB (0.169), Bintang M (0.113), Youtefa (0.104), Simpama Dwi (0.093), Bumi Infrastructure (0.090) Sultan (0.080), and Rajawali (0.077). That is, rankings 1-3 in terms of delivery of the three suppliers never experience delays during the delivery process whenever the company needs raw materials. The value of the consistency ratio (CR) in the comparison criteria is 0.04, which means it is consistent and acceptable because CR ≤ 0.1.

Supplier Rating Based on Product Capacity Criteria

Table 6. Supplier Rating Based on Product Capacity Criteria

No	Supplier	Weight	Rating
1	Rajawali	0.042	7
2	Agung M	0.101	4
3	Sultan	0.034	8
4	SKB	0.298	1
5	Bintang M	0.140	3
6	Youtefa	0.095	5
7	Bumi Infrastruktur	0.245	2
8	Simpama Dwi	0.044	6
Inconsistency = 0.05			

Source: data processed, 2019

The results of the Expert Choice analysis in the figure show that suppliers based on price criteria are ranked 1-8 in sequence, namely: SKB (0.298), Bumi Infrastructure (0.245), Bintang M (0.140), Agung M (0.101), Youtefa (0.095), Simpama Dwi (0.044), Eagle (0.042), and Sultan (0.034). That is, ranking 1-3 in product capacity, suppliers can meet the number of requests for the company's raw materials according to the needs of the job. The consistency ratio (CR) value in the comparison criteria is 0.05, which means it is consistent and acceptable because CR ≤ 0.1.

Total Supplier Rating

The total final rating of crushed stone suppliers for foundation layer A and foundation layer B in the Holtekamp Bridge Access Road Development Project is obtained by multiplying the criteria weight value with the alternative weight value, which is processed in the Expert Choice application.

Table 7. Total Supplier Final Rating

No	Supplier	Weight	Rating
1	Rajawali	0.076	8
2	Agung M	0.238	1
3	Sultan	0.176	2
4	SKB	0.117	3
5	Bintang M	0.092	6
6	Youtefa	0.114	4
7	Bumi	0.102	5

No	Supplier	Weight	Rating
	Infrastruktur		
8	Simpama Dwi	0.085	7
Inconsistency = 0.05			

Source: data processed, 2019

Combined instance – Synthesis with respect to:
Goal: Pemilihan Pemasok pada Pembangunan Proyek Pebangunan Jalan Akses Jembatan Holtekamp Jayapura
Overall Inconsistency = .05

Agung M .238
Sultan .176
SKB .117
Youtefa .114
Bumi Inf. .102
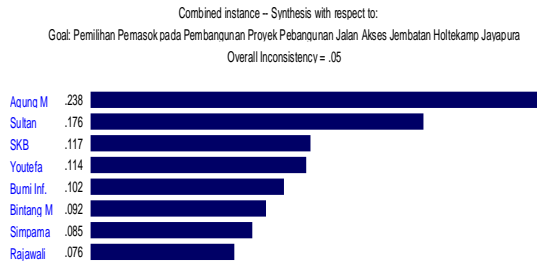Bintang M .092
Simpama .085
Rajawali .076

Figure 1. Supplier's Final Priority
Source: data processed, 2019

Based on table 7, it can be concluded that the best suppliers to supply LPA and LPB materials for the Bridge Access Road Development Project in order from 1 to 8 are suppliers Agung M (0.238), Sultan (0.178), SKB (0.117), Youtefa (0.114), Bumi Infrastruktur (0.102), Bintang M (0.092), Simpama Dwi (0.085), and Rajawali (0.078).

Furthermore, the best 3 (three) suppliers of crushed stone for foundation layer A and foundation layer B can be chosen by PT. PP-HK in the Holtekamp bridge access road development project sequentially is Agung M, Sultan, and the last one is SKB. This means that the top three suppliers are the company's top priority suppliers in meeting the demand for raw materials.

Conclusion

Based on the research objectives and research results in determining the best supplier in the Holtekamp access road construction project using Process Hierarchy Analysis (AHP), the following conclusions can be drawn. To determine the best supplier, there are 4 (four) criteria, namely quality, price, delivery speed, and production capacity. The results of the analysis using Expert Choice show that the price criterion is in the first position with a weight value of 0.392, the quality criterion is in the second rank with a weight value of 0.316, the delivery speed criterion is in the third rank with a weight value of 0.181, and

the product capacity criteria is in the fourth rank with a weight value of 0.111.

Meanwhile, based on the data processing above, it can be concluded that the final ranking of the best suppliers sequentially, namely for supplying LPA and LPB materials for Bridge Access Road Development Projects from sequence 1-8, is supplier Agung M (0.238), Sultan (0.178), SKB (0.117), Youtefa (0.114), Bumi Infrastructure (0.102), Bintang M (0.092), Simpama Dwi (0.085), and Rajawali (0.078). Moreover, the 3 (three) best suppliers the company can choose are Agung M, Sultan, and SKB.

Suggestion

Companies pay attention to each criterion because each alternative has different advantages. So the company must be able to combine each criterion and adapt to the provisions of the company. This is because the research results show that the 3 (three) top priority suppliers that the company can choose, namely Agung M, Sultan, and SKB, are different from the 3 (three) suppliers that the company has chosen, namely Agung M, Sultan, and Bumi Infrastruktur. Further researchers can use other criteria following the policies of each company. In addition, because the possibility of respondents being inconsistent in filling out the questionnaire is substantial, it is better for each stage of completing the questionnaire to be considered and controlled but without coercion so that the questionnaire results are valid and do not repeat data collection.

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