E-Procurement System Analysis Using the Analytic Hierarchy Process (AHP) Method at Mining Contractor Company

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Abstract. Supplier selection is very important in ensuring supply chain activities can run well. This study aims to determine the factors that are taken into consideration in supplier selection, as well as the effectiveness of following the procurement process through the e-procurement system with the Analytic Hierarchy Process (AHP) method in mining contractor companies. The data collection technique used was a questionnaire to 25 worker respondents. The data processing method with the AHP method is to calculate the matrix consistency ratio and the hierarchy consistency ratio. This research is focused on suppliers of Information Technology product providers by considering 4 supplier criteria factors, namely price, quality, delivery time and warranty. The AHP analysis that has been carried out is then applied to the E-Procurement system. The AHP analysis produces a weighting value for each criterion with the criteria codes K1, K2, K3 and K4. This weighting value will be applied in the E-procurement system to determine the best supplier. From the results of E-procurement there are 4 suppliers involved in this selection that match the 4 criteria factors. For the level of effectiveness of the application of goods procurement through the e-procurement process and AHP in mining contractor companies, it is very good so that from this process we can find out the best suppliers and deserve to be suppliers. The results obtained from the four suppliers who have the best criteria based on all criteria with a value of 1.001.

1 Introduction

The development of technology and information in the modern era as it is today requires all lines of business to make improvements to the systems that are already running. Likewise at mining company which is engaged in coal mining contractor services which of course must provide added value to customers. Heavy equipment units must always be ready to work 100% so if there is a breakdown unit must be handled quickly so that it can operate again. Including the availability of IT goods must also always be available at the vendor. Many goods available at various vendors are physically and of the same quality but differ in price and stock availability. This makes a team Procurement at each location area experienced problems, namely prices differed from one work location to another.

In 2021 purchases of IT items such as laptops, monitors & CPUs have increased by 87% compared to 2020 due to the effects of the co-19 pandemic, all vendors have increased prices for goods because import costs have also increased due to restrictions on shipments abroad. Even in 2022 based on data from the SAP system there will be an increase of 54% compared to 2021. In Figure 1.1. You can see a graph of the increase in IT costs over a 3-year period from 2020 to 2022.

Fig. 1.1 Graph IT Cost 2020 – 2022

This is a serious concern in the Supply Chain Management Division of a mining contractor company how to achieve high consumable items. It is necessary to design a process flow for ordering IT goods packaged with an e-procurement system to minimize differences in prices and product specifications and prevent fraud. As well as vendor company legality data that can be standardized and documented in a neat and structured manner. One of the tools that can be used to determine the purpose of vendor selection is the Analytical Hierarchy Process (AHP). AHP is a method that provides objective mathematics for subjective preferences in decision making by individuals or groups (Harditya, 2022).
2 literature review

2.1 E-Procurement

E-procurement is the integration and electronic management of all procurement activities including buyer requests, granting rights, delivery orders, and payments between buyers and suppliers (Chaffey, 2004). According to Kalakota, Ravi and Robinson (2001) the benefits of e-procurement are divided into 2 categories: efficient and effective. E-procurement efficiencies include lower costs, speeding up time in the procurement process, better controlling the purchasing process, presenting information reports, and integrating procurement functions as key to the back-office system. While e-procurement effectiveness is increasing control in the value chain, good management of important data, and improving the quality of decision making in the purchasing process in the organization.

2.2 E-Procurement concept

Sarzana Fulvio di S. Ippolito refers to E-procurement as a set of technologies, procedures and organizational steps that enable the purchase of goods and services online, through the opportunities offered by the internet and e-commerce. This definition is similar to the World Bank’s definition but eliminates "work procurement".

According to Presidential Regulation No. 54 of 2010 article 1 paragraph 37 says that "Electronic procurement or E-procurement is the procurement of goods/services carried out using information technology and electronic transactions in accordance with statutory provisions".

2.3 Supplier

According to Pujawan and ER (2010), suppliers are stakeholders in the success of manufacturers compared to other industries. Suppliers are actively involved in supporting the company’s production process. The price of materials received from suppliers affects production costs and the prices of finished materials offered to consumers. If suppliers do not respond to company requests, the company experiences delays in the supply of raw materials, which even leads to depletion of raw materials and losses for the company due to cessation of production (Utama, 2021).

Therefore it can be concluded that suppliers are a risky part for the company and have a significant influence on the company’s production process. If the company has many suppliers of raw materials, the company must choose the supplier, because if an error occurs in determining the supplier, it will affect the company’s operational activities.

2.4 Selection of Suppliers

Selection of suppliers (suppliers) is one of the strategic steps, especially if the supplier supplies critical components (items). The supplier selection process is part of procurement management. In selecting suppliers, we recognize the existence of criteria. Selection criteria is one of the important things in the supplier selection process. The specified criteria should reflect the strategy of the industry players themselves.

Supplier selection criteria according to (Nydick & Hill, 1992):

a. Quality / quality
b. Price / price
c. Service / services
d. Delivery / delivery

2.5 Analytic Hierarchy Process (AHP)

The Analytic Hierarchy Process (AHP) is a method for solving a complex unstructured situation into several components in a hierarchical arrangement, by giving subjective values about the relative importance of each variable, and determining which variable has the highest priority in order to influence the outcome in that situation. The decision-making process is basically choosing the best alternative.

3 Research method

3.1 Object of research

The object in this research is the supplier of a mining contractor company. Where will be seen the factors that influence the selection of suppliers for mining contractor company with the Analytic Hierarchy Process (AHP) method.

3.2 Research Flow

The flow of research in this Thesis The initial stage of conducting research includes conducting a preliminary study by conducting literature studies and field studies to identify problems related to the selection of suppliers in the company. After that, the formulation of the problem will be investigated further. Next, collect alternative supplier data and make supplier selection criteria. The AHP method is used to construct a hierarchical structure. After the hierarchy is created, the next step is to create or design a questionnaire and determine respondents who have competence in the field of procurement in supplier selection. After that, a comparison matrix is calculated and the matrix is normalized. After the data is obtained then perform data processing with the AHP method, namely by calculating the matrix consistency ratio and the hierarchical consistency ratio. If the consistency ratio is ≤ 0.1, analysis can be carried out and it is consistent. But if the consistency ratio is ≥ 0.1, then a reassessment of the questionnaire must be carried out.

3.3 Research Methods

The research method used to obtain the data needed in the preparation of this thesis, namely:

Field Research
a. The research was conducted by direct observation to the location where the author works at the Mining contractor company Jakarta to get an overview of
supplier selection through e-procurement used by mining contractor company, as research will be carried out by:

1. Interview with the author's co-workers in the procurement section of the e-procurement system holder.

2. Observation of the operation of the e-procurement system in carrying out the supplier selection process.

3. Create a questionnaire with a minimum of 25 respondents to obtain supplier selection criteria.

b. Access to the online library

The research was conducted by reading literature books online and other data or information that could provide a theoretical basis for writing this thesis.

3.4 Types of Research and Data Sources

This type of research uses descriptive research with qualitative methods. According to Sugiyono (2016: 9) a qualitative descriptive method is a research method based on philosophy that is used to examine the conditions of natural objects or experiments where the researcher is an instrument of data collection techniques and qualitative data analysis. While the data source used is primary data, namely data obtained through the first source either from individuals or individuals, such as the results of interviews or the results of collecting questionnaires (Sekaran, 2006).

Primary data in this study were obtained from interviews and questionnaires distributed to respondents. While secondary data is obtained from sources that do not directly provide data to the author but through intermediaries of other people or through documents.

3.5 Method of collecting data

1. Library Studies. Library Study is a method of collecting data from books, research reports and journals, both national and international journals.

2. Preliminary Research. Preliminary research was conducted to find out how the profile and condition of the company.

3. Data obtained directly from the company.

3.6 Data Processing and Analysis Methodology

The data analysis used in this study is the AHP (Analytical Hierarchy Process) method. Calculations are done manually using Microsoft excel.

1. Determination of factors that influence the selection of suppliers for mining contractor company

2. The AHP method of data processing uses the Analytical Hierarchy Process through the following steps:
   a. Decomposition (Arrangement of Hierarchical Structure)
   b. Comparative Judgment (Priority Setting), with the following stages:
      1) Make pairwise comparisons against a specified criterion or element.
      2) Unify the opinions of respondents using geometric averages which are systematically written as follows: $A_{ij} = \{Z_1, Z_2, Z_3, \ldots, Z_n\}^{1/n}$. Where $a_{ij}$ states the geometric mean value, $Z_i$ states the comparison value between criteria for the $i$th respondent, and $n$ represents the number of participants (Silalahi, 2009).

   c. Synthesis of Priority (Priority Calculation Approach) Synthesis of Priority is carried out using the eigenvector method to obtain relative weights for decision-making elements, the following approach steps can be used:
      1) Make a comparison matrix of importance levels between criteria.
      2) Create a normalized comparison matrix.
   
   d. Logical Consistency (Comparison Matrix Consistency Test), Consistency calculation steps:
      1) Make a comparison matrix
      2) Create a normalized comparison matrix
      3) Make a priority weight multiplication matrix with the initial matrix
      4) Create a column for the number of matrices "c" divided by the weight (weight vector).

3 Results and discussions

4.1 Completion of the AHP System

The calculation of the results of priority criteria will be carried out by solving problems through the AHP method, there are several principles that must be understood, namely:
1. Create a Hierarchy

Complex systems can be understood by breaking them down into a number of supporting elements, hierarchically arranged, and combining them. In this study, based on Table 4.1, a hierarchy was created as follows:

Table 4.1 Supplier selection criteria

<table>
<thead>
<tr>
<th>No</th>
<th>Criteria Code</th>
<th>Criteria Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>K1</td>
<td>Quality</td>
</tr>
<tr>
<td>2</td>
<td>K2</td>
<td>Cost</td>
</tr>
<tr>
<td>3</td>
<td>K3</td>
<td>Terms of Delivery (Delivery)</td>
</tr>
<tr>
<td>4</td>
<td>K4</td>
<td>Warranty</td>
</tr>
</tbody>
</table>

2. Conduct an assessment of criteria and alternatives

Criteria and alternatives are done by pairwise comparisons. For various issues, a scale of 1 to 9 is the best scale for expressing opinions. On this research, can make 4 criteria supplier selection were made:

a. Quality

Quality is one of the important criteria considered by company in choosing a supplier. And something that can maintain loyalty to the company. Based on Table 4.2, criteria supplier selection from quality.

Table 4.2 Supplier selection criteria from quality factors (Quality)

<table>
<thead>
<tr>
<th>No</th>
<th>Name of Sub Criteria</th>
<th>Mark</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>As requested</td>
<td>4</td>
<td>Very good</td>
</tr>
<tr>
<td>2</td>
<td>&lt;= 1% of request</td>
<td>3</td>
<td>Good</td>
</tr>
<tr>
<td>3</td>
<td>&lt;= 5% of request</td>
<td>2</td>
<td>Enough</td>
</tr>
<tr>
<td>4</td>
<td>&lt; 5% of request</td>
<td>1</td>
<td>Not enough</td>
</tr>
</tbody>
</table>

b. Cost

Cost is one of the most important financial criteria that are the main consideration for every company in choosing a supplier. Based on Table 4.3, criteria supplier selection from cost. The cost stated in the bid submitted to the eprocurement system. The cheaper about price, the greater supplier chances of winning.

Table 4.3 Supplier selection criteria from the Cost factor

<table>
<thead>
<tr>
<th>No</th>
<th>Name of Sub Criteria</th>
<th>Mark</th>
<th>Information</th>
</tr>
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<tbody>
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<td></td>
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</table>

c. Delivery Orders

This Criteria will assess supplier in term of delivery service to the location. Both regarding the timeliness of delivery and the accuracy of the amount of goods sent. Based on Table 4.4, criteria supplier from delivery.

d. Warranty

Warranty has an important psychologic rule for buyers and to complete the three criteria above. Based on Table 4.5, if the warranty period is longer, the chances of winning are better.

5 Conclusion

Wayang for the Javanese society is considered as a guidance in behaving which has been socialized for hundreds of years through traditional performances. The openness as the basis for Wayang makes it survive for such a long time that have been socialised through traditional performance become a formal learning content for character education in Higher Education Institutions.

References

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