



IMPLEMENTATION OF THE SELECTION OF APPAREL SUPPLIERS USING THE AHP (ANALYTICAL HIERARCHY PROCESS) METHOD AT PT. IWAK BANDENG BEKASI

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Abstract

This research was conducted in a company, namely, PT. Iwak Bandeng, who will develop partnership relationships with apparel suppliers. The problem that often occurs is when choosing a supplier. The sample of this research is the decision makers and the parties who are in the purchasing and warehouse departments who know the performance of suppliers. The sampling technique uses judgment sampling because the AHP method requires dependence on a group of experts according to the type of specialist involved in making decisions. This study uses the AHP method assisted by expert choice software. From the results of the assessment of the importance of the criteria in the selection of suppliers, the priority/weighting scales are as follows: priority I quality (0.419), priority II price (0.320), priority III delivery accuracy (0.112), priority IV accuracy in quantity (0.088) and priority V service has a priority scale (0.061). From the results of the assessment of the level of alternative importance in the selection of suppliers, the priority/weighting scale is as follows: priority I supplier CAB (0.481), priority II supplier EF (0.314), priority III supplier RJ (0.205).



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I. INTRODUCTION

Decision makers always make decisions within the company. If the decision to be made is easy, then it can easily make a decision. However, if the decision to be taken is complex with big risks, such as policy formulation, decision makers often need tools in a scientific, logical, and structured form. (Wulandari, 2014)"Basically, every company has the same business orientation, which is to generate maximum profit or profit by minimizing the costs incurred. This can be realized by selecting the right supplier or supplier. Suppliers or suppliers are business partners who play a very important role in ensuring the availability of supply goods needed by the company."[1].

The problem that arises at this time is the difficulty of determining the best supplier from the available options by considering the desired criteria. Procurement in an institution or company has

become a routine activity that always exists from time to time, because according to (Prabowo, 2013)"Procurement is one way to meet institutional needs in the form of goods and services. In every procurement process there must always be careful planning so that there is a match between the number of needs and the existing budget so that there is a process relationship that aims to obtain high benefits and efficiency."[3].

In research (Sulistiyani, et al, 2017) stated that, "The importance of selecting suppliers for the company's business continuity. Therefore, a structured assessment is needed in the supplier selection process that will be used by the company. One method that can be used for supplier selection is the Analytical Hierarchy Process (AHP) method."[4][5]–[7].

II. RESEARCH METHODS

2.1. Research Flow

This study uses the AHP method with the following stages.

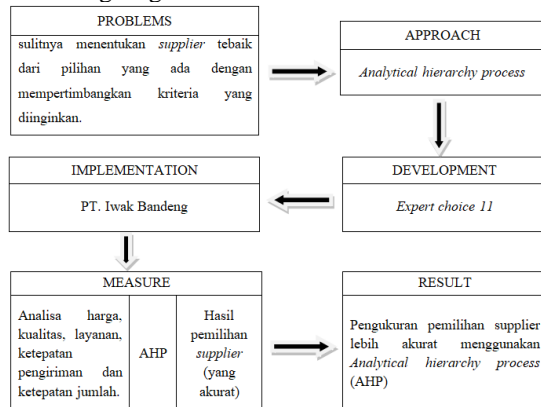


Figure 1. Research Stages

The stages of the research methodology are described in general as follows:

- A. Problems
In this study there are problems or problems at PT. Iwak Bandeng in supplier selection.
- B. Approach
The method used for supplier selection at PT. Iwak Bandeng is an Analytical Hierarchy Process (AHP).
- C. Development
The application used to analyze supplier selection at PT. Iwak Bandeng is Expert Choice 11.
- D. Implementation
Data taken directly from the purchasing department of PT. Iwak Bandeng through a questionnaire.
- E. Measurement
Processing data on the influence of price, quality, service, delivery accuracy and the accuracy of the Analytical Hierarchy Process (AHP) amount to measure accurate supplier selection
- F. Result
Analyzing the results of processing data on price, quality, service, delivery accuracy and quantity accuracy using the Analytical Hierarchy Process (AHP) method to obtain an accurate supplier selection.

2.2 Data Collection Method

In a study can not be separated from the data. There are several types and sources of data used in scientific research, the following are the types of data and data sources that the authors use in this study:

1. Primary Data

Primary data is data obtained from the first source either from individuals or individuals, such as the results of interviews or the results of collecting questionnaires. The primary data in this

study were obtained from interviews and questionnaires distributed to respondents at PT. Iwak Bandeng.

a) Interview

From the results of preliminary interviews obtained variables (criteria) used in the selection of suppliers at PT. Iwak Bandeng, which are as follows:

Table 1. The criteria used in the selection of suppliers at PT. Iwak Bandeng

Price (Price)	
H1	Appropriateness of the price with the quality of the goods produced
H2	Ability to provide discounts (discounts) on orders of a certain quantity
Quality (Quality)	
Q1	Conformity of goods with predetermined specifications
Q2	Provision of goods without defects
Q3	Ability to provide consistent quality
Service	
S1	Easy to contact
S2	Ability to provide information clearly and easily understood
S3	Speed in responding to customer requests
S4	Respond quickly in resolving customer complaints
Delivery Accuracy (Delivery)	
D1	Ability to deliver goods according to the agreed date
D2	Ability in handling transportation system
Quantity Accuracy	
J1	the accuracy and suitability of the quantity in the delivery

b) Questionnaire

The data collection technique used in this study was to use a questionnaire or questionnaire, to obtain data about the indicators developed in this study. The questionnaire was conducted by submitting a list of questions to 5 respondents, namely the decision makers at PT. Milkfish Iwak. The statements in the questionnaire were made using the Saaty scale.

Table 2. Saaty Scale Data Collection Method

Level of Interest	Definition
1	Equally important
3	A little more important
5	Obviously more important
7	Very clearly more important
9	Definitely/absolutely more important (extreme importance)
2,4,6,8	If in doubt between two adjacent values
1/(1-9)	The inverse of the importance level on a scale of 1-9

Source:(Saaty, 2016:8)[8][9], [10]

c) Secondary Data

Secondary data is primary data that has been further processed and presented either by primary data collectors or other parties. Secondary data collected include company profiles, literature studies, and company records or documents.

2.3 Data Analysis Method

Analysis of the data used in this study is the AHP method. Calculations can be done manually using Microsoft Excel or with the help of expert choice software. Basically the procedures or steps in the AHP method include according to Kusriani (2017:135).[11].

1. Defining the problem and determining the desired solution, then compiling a hierarchy of the problems encountered. The arrangement of the hierarchy is to set goals that are the goals of the overall system at the top level.
2. Determine the priority of the elements.
 - a. The first step to determine the priority of the elements is to make a pair comparison, which is to compare the elements in pairs according to the given criteria.
 - b. The pairwise comparison matrix is filled in using numbers to represent the relative importance of an element to other elements.

3. Synthesis.

The considerations for pairwise comparisons are synthesized to obtain overall priorities. The things that are done are:

- a. Sum the values of each column of the matrix.
- b. Divides each value from the column in the matrix.
- c. Add up the values of each row and divide by the number of elements to get the average value.

4. Measure consistency.

In decision making, it is important to know how good the consistency is because we don't want judgmental decisions with low consistency. The things to do for this step are:

- a. Multiply each value in the first column by the relative priority of the first element, the value in the second column by the priority of the second element, and so on.
- b. Sum each row.
- c. The result of the row sum is divided by the corresponding relative priority element.
- d. Add the quotient above with the number of elements present, the result is called max.

5. Calculate the Consistency Index (CI) with the formula:

$$CI = (\lambda \text{ max} - n) / n - 1$$

Where:

n = number of elements

6. Calculate the consistency ratio (CR) with the formula:

$$CR = CI/IR$$

Where:

CR = Consistency Ratio

CI = Consistency Index

IR = Random Consistency Index

7. Check the consistency of the hierarchy.

If the value is more than 10% then the judgment data assessment must be corrected. However, if the consistency ratio (CR/IR) is less or equal to 0.1 then the calculation results can be declared correct.

III. RESULTS

3.1 Hierarchical Structure

After the problem is defined, the next step is to break the whole problem into its elements. Solving is also carried out on the elements until it is impossible to do further solving to get accurate results.

In the AHP method, the criteria are usually arranged in a hierarchical form. The criteria and sub-criteria in this study are the criteria and sub-criteria used by the company in selecting suppliers, which were obtained from the results of preliminary interviews.

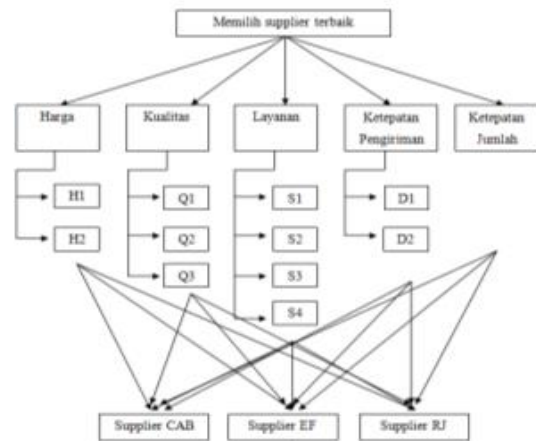


Figure 2 Hierarchical Structure of Supplier Selection Problems of PT. Iwak Bandeng Bekasi

3.2 Comparison Between Criteria

The data for the measurement of the priority importance of the criteria in the selection of suppliers is obtained through a questionnaire distributed to 5 respondents, namely the director, Operational manager, head of purchasing, head of finance, and head of warehouse in charge of receiving goods. After the assessment of 5 respondents was obtained, then the results were averaged using the geometric mean (geometric mean). This is done because AHP only requires one answer for the comparison matrix.

	HARGA	KUALITAS	LAYANAN	PENGIRIMAN	JUMLAH
HARGA		1,0	3,9487	3,72792	2,86194
KUALITAS			5,93277	5,33454	5,30457
LAYANAN				(2,0)	(2,0)
PENGIRIMAN					2,07427
JUMLAH	Incom: 0,04				

Figure 3 Assessment of Priority Interest Criteria in Supplier Selection

From the results of the calculation of pairwise comparisons between variables in choosing suppliers above, the weights shown in Figure 3.

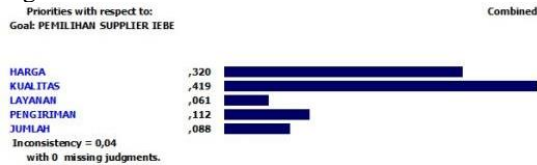


Figure 4. Priority of Interest (Weight) Criteria in Supplier Selection

3.3 Comparison of Supplier Assessment Alternatives for Each Criterion and Sub-criteria

Calculate the weight/priority of each variable at level 3 (alternative), namely the weight of each supplier compared to each sub-criteria.

The data for measuring the priority of the sub-criteria importance of each criterion in the selection of suppliers is obtained through a questionnaire distributed to 5 respondents, namely the director, Operational manager, head of purchasing, head of finance, and head of warehouse in charge of receiving goods.

After the assessment of 5 respondents was obtained, then the results were averaged using the geometric mean (geometric mean). This is done because AHP only requires one answer for the comparison matrix. The following is the weight of each alternative against the sub-criteria in supplier selection:

A. Price Criteria

1) Sub-criteria for appropriateness of price with quality (H1)

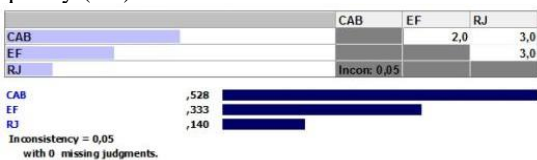


Figure 5. Priority of Interest (Weight) of Alternatives in the Sub-criteria of Appropriateness of Price with Quality

The data above shows that in the sub-criteria of appropriateness of price with quality (H1), the CAB supplier is the supplier that best meets this sub-criteria with a weight of 0.528. Furthermore, the EF supplier is ranked second with a weight of 0.333 and the RJ supplier has a weighted value of 0.140.

2). Sub-criteria Ability to provide discounts (discounts) on orders in a certain quantity (H2)

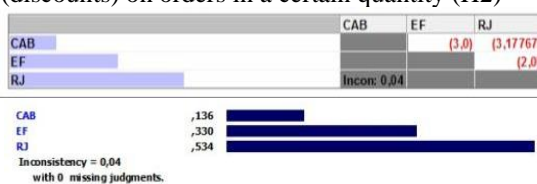


Figure 6 Alternative Interest Priority (Weight) in the Ability to Give Discounts Sub-criteria

The data above shows that in the sub-criteria of the ability to provide discounts (H2), the RJ supplier that most meets this sub-criteria with a weight of 0.534. The next priority in this sub-criteria is the EF supplier with a weight value of 0.330, then the CAB supplier as the last priority with a weight value of 0.136.

B. Quality Criteria

1). Sub-criteria for conformity of goods with specified specifications (Q1)

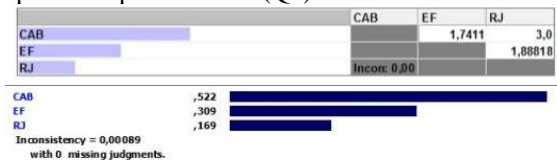


Figure 7. Priority of Interest (Weight) of Alternatives on Sub-criteria for Conformity of Goods with Defined Specifications

The data above shows that in the sub-criteria of conformity of goods with the specified specifications (Q1), the CAB supplier that most meets this sub-criteria with a weight value of 0.522. The next priority is the EF supplier with a weight value of 0.309, and the last priority in this sub-criteria is the RJ supplier with a weight value of 0.169.

2) Sub-criteria for the provision of goods without defects (Q2)

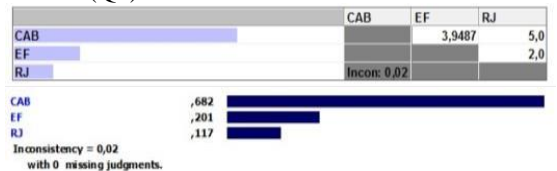


Figure 8. Priority of Interest (Weight) of Alternatives in the Sub-criteria for the Provision of Flawless Goods

The data above shows that the CAB supplier with a weight of 0.682 is the supplier that best meets the sub-criteria for providing goods without defects (Q2). While the EF supplier is the second priority with a weight of 0.201 and the RJ supplier is the next priority with a weighted value of 0.117.

3) Ability to Provide Consistent Quality Sub-criteria (Q3)

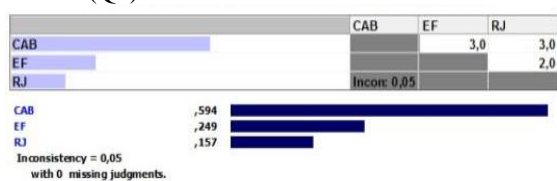


Figure 9. Priority of Interest (Weight) Alternative

on Sub-criteria Ability to Provide Consistent Quality

The data above shows that in the ability to provide consistent quality sub-criteria (Q3), CAB suppliers with a weight value of 0.594 have the first priority to be selected based on this sub-criteria. The second priority is to choose an EF supplier with a weight value of 0.249, and the last priority is to choose an RJ supplier that has a weight value of 0.157.

C. Service Criteria

1) Ease of Contact Sub-criteria (S1)

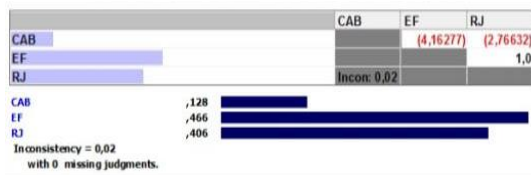


Figure 10. Priority of Interest (Weight) of Alternatives in the Ability to Provide Consistent Quality Sub-criteria

The data above shows that in the ease of contact sub-criteria (S1), the EF supplier has the first priority to be selected with a weight value of 0.466. The second priority is the RJ supplier with a weight value of 0.406. While the CAB supplier occupies the third priority with a weight value of 0.128.

2) Sub-criteria of Ability to Provide Information in a Clear and Easy to Understand (S2)

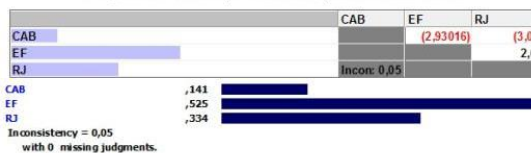


Figure 11. Priority of Interest (Weight) Alternatives in the Sub-criteria of Ability to Provide Information in a Clear and Easy to Understand

The data above shows that in the sub-criteria of the ability to provide information clearly and easily (S2), the first priority to be selected is the EF supplier with a weight value of 0.525. The second priority is the RJ supplier with a weight value of 0.334. While the CAB supplier occupies the last priority to be selected based on this sub-criteria with a weight value of 0.141.

3) Speed Sub-criteria in Responding to Customer Requests (S3)



Figure 12. Priority of Interest (Weight) Alternative on Speed Subcriteria in Responding to Customer Request

The data above shows that in the speed sub-criteria in terms of responding to customer requests (S3), the first priority is the RJ supplier with a weight value of 0.546. While the second priority is the EF supplier with a weighted value of 0.345, and the last priority is the CAB supplier with a weighted value of 0.109.

4) Quick Response Sub-criteria in Resolving Customer Complaints (S4)

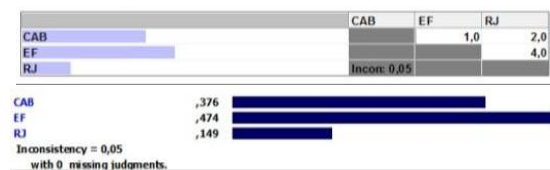


Figure 13. Alternative Interest Priority (Weight) in the Quick Response Sub-criteria in Resolving Customer Complaints

The data above shows that in the sub-criteria for being responsive in resolving customer complaints (S4), the EF supplier is the first priority supplier to be selected based on this sub-criteria with a weight value of 0.474. Furthermore, the second priority is the CAB supplier with a weight value of 0.376, and the last priority is the RJ supplier with a priority weight of 0.149.

D. Delivery Accuracy Criteria

1) Sub-criteria for the ability to deliver goods according to the agreed date (D1)

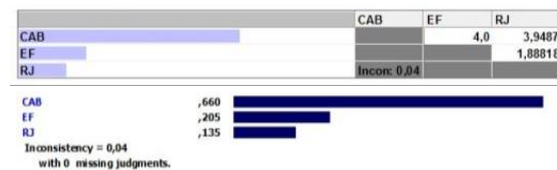


Figure 14. Alternative Interest Priority (Weight) In the Sub-criteria of Ability to Deliver Goods According to the Agreed Date

The data above shows that the CAB supplier with a weighted value of 0.660 is the first priority to be selected on the sub-criteria of the ability to deliver goods according to the agreed date (D1). While the EF supplier with a weighted value of 0.205 is the second priority, and the RJ supplier with a criterion weight of 0.135 is the last priority.

2) Capability Sub-criteria in terms of handling transportation systems (D2)

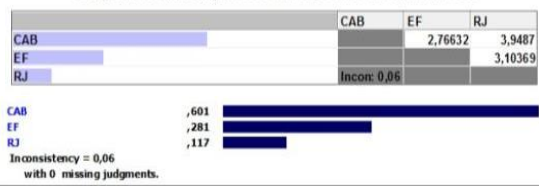


Figure 15. Alternative Interest Priority (Weight) in the Ability to Deliver Goods Sub-criteria in accordance with the agreed date

The data above shows that in the capability sub-criteria in terms of handling the transportation system (D2), the CAB supplier with a weight value of 0.601 is the first priority to be selected. While the second priority is the EF supplier with a weight value of 0.281, and the last priority is the RJ supplier with a weight value of 0.117.

E. Quantity Accuracy Criteria

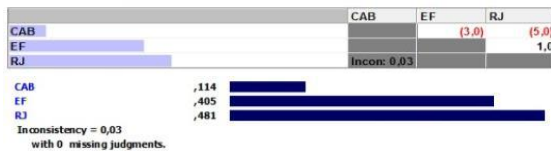


Figure 16. Priority of Interest (Weight) Alternatives on Amount Accuracy Criteria

IV. CONCLUSION

Based on the research objectives and the results of the research above, it can be concluded the following things:

1. The most influential criteria in the selection of apparel suppliers at PT. Iwak Bandeng are as follows:



Figure 2. Weight Graph of Supplier Selection Criteria for PT. Iwak Bandeng

2. Global priority (global priority) sub-criteria in the selection of suppliers in a row from the first priority to the last priority are as follows:

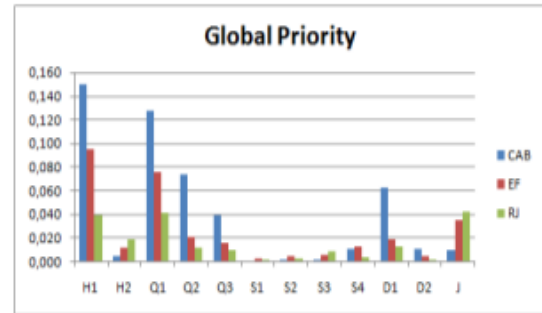


Figure 3. Global Priority Chart for Supplier Selection of PT. Milkfish Iwak

3. Based on the criteria and sub-criteria in supplier selection, overall CAB suppliers are rated as the best suppliers with a weight of 0.481. The next priority is the EF supplier with a weight value of 0.314 and the last priority is the RJ supplier with a weight value of 0.205. This shows that overall the best apparel supplier for the company to serve as a long-term partner/partner is the CAB supplier because overall this supplier has the highest value compared to the other two suppliers.

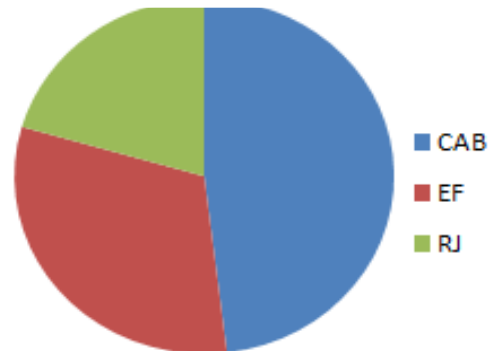


Figure 4. Graph of Final Assessment of Supplier Selection of PT. Iwak Bandeng

4. For further researchers, researchers can use other criteria in accordance with the policies of each company and use other methods, such as Multi Criteria Decision Making with Promethee.

REFERENCES

[1] N. Wulandari, "Perancangan Sistem Pendukung Keputusan Pemilihan Supplier di PT . Alfindo Dengan Metode Analytical Hierarchy Process (AHP).," *J. Sist. Inf.*, vol. 1, no. 1, hal. 4-7, 2014.

[2] A. Nugraha dan A. Octasia, "Sistem Informasi Penjualan Kaos Berbasis Web Pada Distro Sickness Berbasis E - Commerce," *Semin. Nas. Ilmu Pengetah. dan Teknol. Komput. Nusa Mandiri*, hal. 299-302, 2016.

- [3] Y. Agus Pranoto, M. Muslim, dan R. Nur Hasanah, "Rancang Bangun dan Analisis Decision Suppor System Menggunakan Metode Analytical Hierarchy Process untuk Penilaian Kinerja Karyawan," *J. EECCIS*, vol. 7, no. 1, hal. 91–96, 2013.
- [4] E. Sulistiyani, M. Idil, H. Amir, K. R. Yusuf, dan D. Injarwanto, "Implementasi Metode Analytical Hierarchy Process (AHP) Sebagai Solusi Alternatif Dalam Pemilihan Supplier Bahan Baku Apel Di PT . Mannasatria Kusumajaya," *Technol. Sci. Eng. J.*, vol. 1, no. 2, hal. 87–101, 2017.
- [5] H. Li, F. Ni, Q. Dong, dan Y. Zhu, "Application of Analytic Hierarchy Process in Network Level Pavement Maintenance Decision-making," *Int. J. Pavement Res. Technol.*, 2017.
- [6] A. Prakoso dan N. Negoro, "Analisa Strategi Pemasaran Produk Kosmetik Wardah Dengan Pendekan SWOT-AHP (Analytic Hierarchy Process)," *J. Sains dan Seni ITS*, vol. 6, no. 1, hal. 62–67, 2017.
- [7] Sunarto dan R. Asmara, "Sistem Pendukung Keputusan Pemilihan Handphoone Metode Analytical Herierarchy Process (AHP) Berbasis PHP," *Politek. Elektron. Negeri Surabaya*, hal. 1–5, 2011.
- [8] T. L. Saaty, *The Analytic Hierarchy Process*. 1980.
- [9] S. Abadi *et al.*, "Implementation of fuzzy analytical hierarchy process on notebook selection," *Int. J. Eng. Technol.*, vol. 7, no. 1, hal. 238–243, 2018.
- [10] S. W. Satria Abadi, "The Model of Determining Quality of Management Private Higher Education Using FAHP (Fuzzy Analytic Hierarchy Process) Method," in *ICESIA 1*, 2016, vol. 1, no. 1, hal. 166–172.
- [11] Kusrini, *Konsep dan Aplikasi Sistem Pendukung Keputusan*, Ed. 1. Yogyakarta: Penerbit Andi Yogyakarta, 2007.