Determining The Best Coffee Menu Using AHP Method On Khobu Coffee

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Abstract. Khobu Coffee is a business unit that sells various coffee menus to its customers every day. The various coffee menus have their characteristics according to the interests of the infringer who buys or orders from the available coffee menu. In fact, in determining the best coffee menu used at Khobu Coffee, based on the survey results, the author has not used a system that can select the best coffee menu based on coffee beans from the menu. Therefore we need a system that can assist in supporting decision-making more quickly, precisely, and accurately. One of them is using the Analytic Hierarchy Process (AHP) method because this method is one method that can perform multiple and detailed criteria with a comprehensive framework and consideration of the hierarchical process which is then calculated for each criterion in determining the best coffee beans. The criteria used are taste, price, aroma, body (thickness level), and acidity (acidity level). The programming language used in building the system is PHP with MySQL. The results of the implementation of the system that has been built show that the AHP method can provide objective decisions in determining the best coffee beans.

Keywords— DSS, AHP, Coffee Beans

1. Introduction

Coffee is a type of beverage that goes through the process of managing coffee beans. Getting a cup of coffee goes through a very long process from post-harvest management cultivation to processing. Coffee is one of the plantation commodities that has a fairly high economic value among other plantation crops and plays an important role as a source of foreign exchange for the country as well as a source of income for coffee farmers in Indonesia. Khobu Coffee is one of the Coffee Shops that sell processed coffee drinks with many flavor variants, so far, they have been selling manually, so that collections and records sales just become a pile of paper and will disappear without any sales history. This will make it difficult for them to determine the best flavor variant of their product. For that Khobu Coffee needs a digital innovation to make it easier for them to determine the best coffee flavor variant so that they can easily determine the stock of ingredients that will be used. The development of information technology that is growing can create various kinds of digital systems that can help complete human work. One form of application of information technology is a Decision Support System. A Decision Support System is a part of a computer-based information system that is used to support decision-making in an organization

or company. Many algorithms are used in Decision Support Systems, one of which is the AHP (Analytical Hierarchy Process) Algorithm.
Khotimah & Ipnuwati (2018) with their research entitled "Selecting the Best Café Using the AHP Method" with the results of the test the ranking and weight of Cafe 3 or P3 get the highest score, namely 0.31 weight category assessment with a predetermined weight value.
Rahmatullah & Abdurrahman (2020) In his research entitled "Decision Support System for Determining the Best Coffee Land Using the AHP (Analytic Hierarchy Process) Method" aims to facilitate the people of Gunung Gijul Village in determining the best coffee land so that it can increase the amount of coffee production. This system determines the best coffee land with several criteria used by organic elements, soil minerals, water sources, land slope, and previous plants.

2. Research Method

2.1. Identifying the Problem
This stage identifies the problem to be discussed, related to the Decision Support System for selecting the best coffee menu at Khobu Coffee using the AHP method.

2.2. Data Collection
To analyze the data, several work steps are needed as follows:
1. Interview
In this study, researchers conducted direct interviews with the parties or owners of Khobu Coffee.
2. Observation
Observations were made by collecting data from Khobu Coffee and noting important things related to determining the best coffee menu at Khobu Coffee.
3. Literature Study
Literature study is done by reading, quoting from books and journals related to this research.

2.3. System Requirements Analysis
At this stage of analysis the system requirements are carried out in 2 stages, namely as follows:
1. Functional Requirements are basic needs that can be carried out by the system and in receiving input for processing to produce output. The functional requirements of the decision support system for determining the best coffee menu are:
    a. The system can display data on several coffee menus from Khobu Coffee
    b. The system can calculate the Analytic Hierarchy Process (AHP) process
    c. The system can display the results of the decision to determine the best coffee menu
2. Non-functional requirements, analysis of non-functional requirements contains the limitations of services or functions provided by the system. This non-functional requirement includes the hardware and software used.

2.4. Implementation of AHP
The AHP method is a functional hierarchy with the main input being human perception, the existence of a hierarchy allows complex problems to be broken down in each problem and then arranged in a hierarchical form. Problem-solving with AHP has several stages, namely:
1. Decomposition
Defining the problem and for the desired solution, breaking the whole problem into its elements, and describing it in a hierarchy that begins with setting general goals.
2. Pair of Comparison
The first is to make pairwise comparisons, which is to compare elements in pairs according to the given criteria. Paired matrices are filled using numbers to represent their relative importance to other elements.
3. Priority Synthesis (Synthesis of Priority) Performed by adding up the values of each column in the matrix. Then divide each value from the column by the corresponding column total to obtain a

normalized matrix. After that add up the values of each row and divide by the number of elements to get the priority value
4. Logical Consistency, namely Checking the consistency of the assessment between criteria.
5. Finding the CI (Consistency Index) value
6. Finding the CR (Consistency Ratio) value
7. Checking the consistency of the hierarchy, what is measured is the consistency ratio by looking at the consistency index. If the CR value is > 0.1 then the data judgment assessment must be corrected. Repeat steps 3,4 and 5 for the entire hierarchy level. If CR < 0.1, then the pairwise comparison value in the given criteria matrix is consistent.

3. Result and Discussion

In determining the best coffee menu using the AHP method on Khobu Coffee, it has been determined and agreed on the criteria and alternatives that will be used in determining the best coffee menu. The criteria and alternatives used to determine the best coffee menu are as follows:

3.1. Alternative Data

The alternatives that are determined to be used in determining the best coffee menu are in Table 1 below:

Table 1. Data Alternative

No	Kode	Alternatives
1	A1	Khobu Pandan
2	A2	Khobu Sanger
3	A3	Espresso
4	A4	V60
5	A5	Americano

3.2. Data Criteria and Sub Criteria

The criteria determined to be used in determining the best coffee menu are in Table 2 below:

Table 2. Data Criteria

No.	Kode	Kriteria (K)
1.	K1	Rasa
2.	K2	Harga
3.	K3	Aroma
4.	K4	Body (Tingkat Kekentalan Kopi)
5.	K5	Acidity (Tingkat Keasaman)

Sub-criteria is an assessment of the criteria. The following are the sub-criteria with their priority values:

Table 3. Data SubCriteria

No	**Criteria**	**Sub Criteria**	**Bobot**
1	Rasa	Manis	5
		Asam	3
		Pahit	1
2	Harga	Rp 15.000 – Rp 20.000	5
		Rp 21.000 – Rp 25.000	4
		Rp 26.000 – Rp 30.000	3
		Rp 31.000 – Rp 35.000	2

		Rp 36.000 – Rp 40.000	1
3	Aroma	Sangat tajam tercium	5
		Cukup Tajam tericum	3
		Kurang tajam tercium	1
4	Body	Heavy (Berat)	5
		High	4
		Light	3
		Medium	2
		Clean	1
5	Acidity	Sangat asam	5
		Asam	4
		Cukup asam	3
		Kurang asam	2
		Tidak asam	1

3.3. Determine the criteria comparison matrix

In determining the comparison matrix between the criteria used, the first step is to determine the priority of the elements of all criteria based on the value of the intensity of interest between the criteria. The value of the intensity of interest is determined based on the value of the comparison scale. The value of the importance scale of the criteria can be seen in Table below:

Table 4. Pairwise Comparison Rating Scale

Nilai	**Keterangan**
1	Kedua elemen sama pentingnya
3	Elemen yang satu sedikit lebih penting daripada yang lainnya
5	Elemen yang satu lebih penting daripada elemen lainnya
7	Satu elemen jelas lebih mutlak penting daripada elemen lainnya
9	Satu elemen jelas mutlak penting daripada elemen lainnya
2,4,6, 8	Nilai-nilai antara dua nilai pertimbangan yang berdekatan
Kebalikan	i memiliki nilai kebalikannya dibanding j

Then determine the value of the comparison between criteria based on the value of the comparison scale

Table 5. Pairwise Comparison Matrix for All Criteria

Criteria	K1	K2	K3	K4	K5
K1	1	1	2	5	7
K2	1	1	5	7	9
K3	1/2	1/5	1	5	7
K4	1/5	1/7	1/5	1	5
K5	1/7	1/9	1/7	1/5	1

3.4. Determining the Sub-Criteria Comparison Matrix

Then compare the importance value of the sub-criteria of each criterion based on the value of the comparison scale. The value of the importance scale between the sub-criteria for each criterion is as follows. example for "Rasa" criteria

Table 6. Pairwise Comparison Matrix of Taste Criteria

	Manis	Asam	Pahit
Manis	1	3	5
Asam	1/3	1	3
Pahit	1/5	1/3	1

Then all the results of pairwise comparisons between the sub-criteria are normalized so that the matrix is obtained

Table 7. Normalization of Taste Criteria Matrix (K1)

	Manis	Asam	Pahit
Manis	1	3	5
Asam	0.33	1	3
Pahit	0.20	0.33	1

Then measure the consistency ratio (Consistency Ratio) from the results of the comparison matrix between the sub-criteria in the Taste Criteria (K1) which has been carried out with the following steps:
Measuring consistency:

Max value = (1.945 x 0.633) + (0.790 x 0.260) + (0.319 x 0.106)
= 4.055 / 5
= 1.35

Because the matrix is of order 5 (consisting of 5 criteria), the Consistency Index value obtained is:
= (1,35 – 5) / (5-1)
= -0,824

Random Index : for *RI* = 1,12
= -0,824 / 1,12
= -0,824

do a comparison of the importance value of the sub-criteria of each Harga, Aroma, Body and Acidity.

3.5. Global Matrix Calculation AHP Method

Calculation of the global matrix on the AHP method to obtain the final alternative ranking value as shown in Table

Table 8. Global Matrix

Criteria	Prioritas	Khobu Pandan	Khobu Sanger	Espresso	V60	America no
Rasa (K1)	0.293	1.000	1.000	0.411	0.411	0.167
Harga (K2)	0.398	0.529	1.000	0.529	0.151	0.151
Aroma (K3)	0.205	0.411	0.411	1.000	1.000	1.000
Body (K4)	0.072	0.517	0.267	0.267	1.000	1.000
Acidity(K5)	0.031	0.134	0.134	0.517	0.517	0.517

Then perform a global calculation to find the total ranking of each alternative with the following calculations:

Khobu Pandan
(A1) = (1,000 + 0.529 + 0.411 + 0.517 +0.134) = 2,593
Khobu Sanger (A2) = (1,000 + 0.517 + 0.411 + 0.517 + 0.267) = 2.813
Espresso (A3) = (0.411 + 0.517 + 0.411 + 1,000 + 0.267) = 2,725
V60 (A4) = (0.411 + 0.267 + 1,000 + 1,000 + 0.517) = 3.080
Americano (A5) = (0.167 + 0.267 + 1,000 + 1,000 +0.517) = 2.836

Then from the global matrix calculation of the five alternatives to obtain a ranking:

Table 9. ranking

Alternatives	Nilai Akhir	Ranking
Khobu Pandan (A1)	2.593	5
Khobu Sanger (A2)	2.813	3
Espresso (A3)	2.725	4
V60 (A4)	3.080	1
Americano (A5)	2.836	2

Based on the case examples above, it can be concluded that to determine the best coffee beans with the AHP method, the final value of suitability is different where V60 (A4) which is declared the best coffee menu is due to obtaining the highest final ranking value with a final value of 3,080.

3.6. System Implementation Results

1. Login Menu

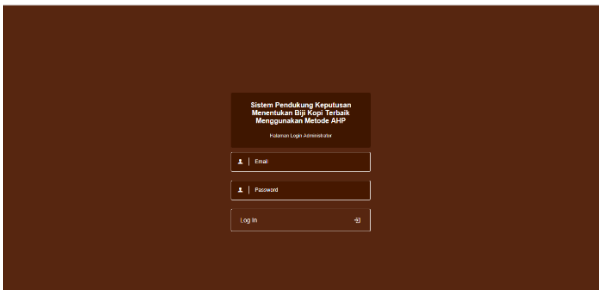

Figure 1. Login

Login page, an administrator who has the right to log in by entering the correct email and password, and then the admin will go directly to the main page.

2. Home Page

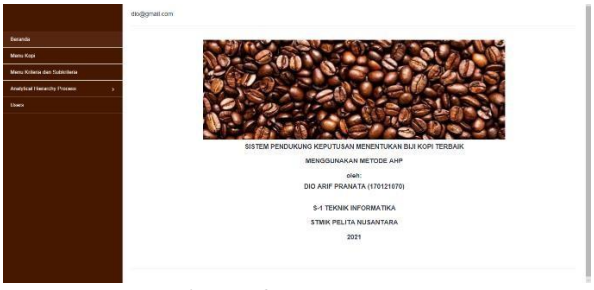

Figure 2. Home Page

The Home page is the initial display that contains several function page menus, namely Home, Coffee Menu Data, Criteria, and Sub Criteria Data, Alternative Analysis, Criteria, and Sub Criteria Analysis, AHP Calculation Results Page, and Users Data Page.

3. Data Page

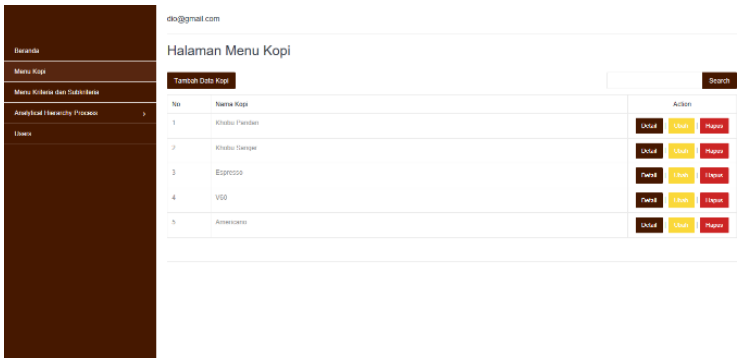

Figure 3. Data menu

The coffee data page contains all the coffee menu data that is used as an alternative to the AHP calculation. Then on this page can add, change and delete from the copy data that can be operated by the administrator.

4. Data Criteria Page

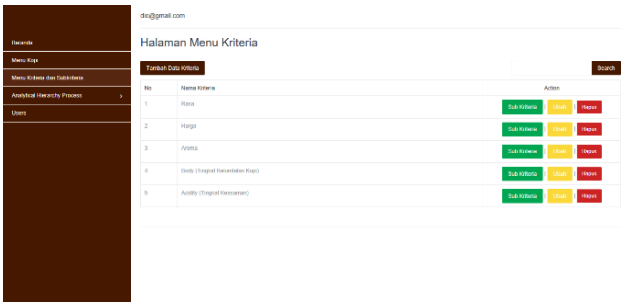

Figure 4. Criteria

The criteria data page contains the criteria data used and is used as a parameter in the AHP calculation to determine the best coffee beans

5. SubCriteria Menu

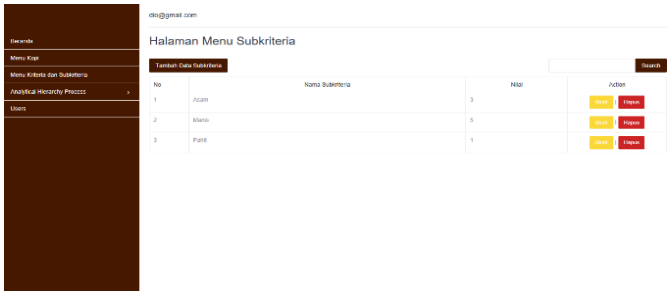

Figure 5. SubCriteria

The sub-criteria data page contains sub-criteria data that is used as a parameter based on the category value for each criterion in the AHP calculation.

6. Alternatif Page

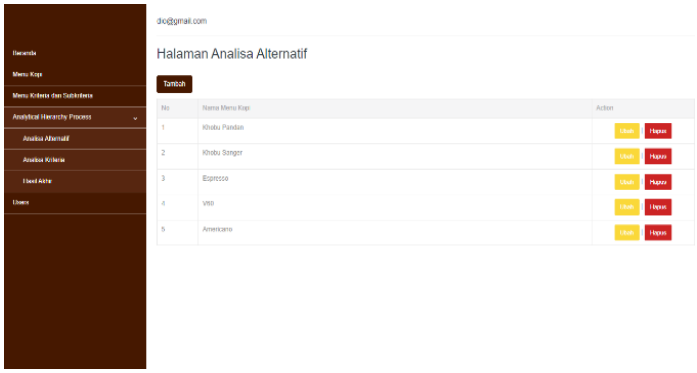

Figure 6. Alternative

The alternative analysis page is used to input category values based on the sub-criteria of the criteria used.

7. Analyse of Criteria

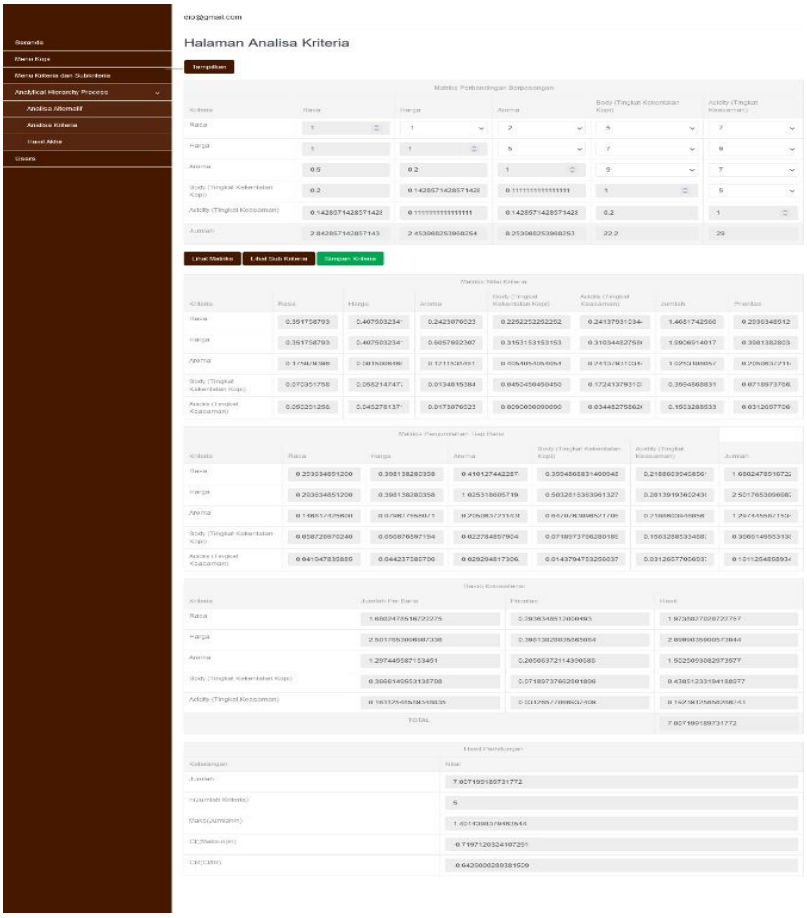

Figure 7 . Analyze of Criteria

The criteria analysis page is used to input the comparison value between criteria in the pairwise comparison matrix and the comparison value between sub-criteria in the paired comparison matrix sub-criteria. Then on this page, it serves to calculate the value of the consistency ratio from the comparison process between criteria to see whether the comparison of criteria has been consistent.

8. Rangking Page

Figure 8 . Rangking Result

4. Conclusion

The decision support system to determine the best coffee menu using the AHP method in this study was designed by applying the Analytic Hierarchy Process (AHP) method in this study, it can be seen that the method is capable of making decisions in determining the ranking of the best coffee menu using predetermined criteria, then determining the value of the pairwise comparison matrix between criteria and sub-criteria to calculate the value of the consistency ratio from the results of comparisons between criteria obtained a consistent value from the pairwise comparison matrix between criteria with the best menu in V60 (A4) which was declared the best coffee menu because it obtained the highest final ranking value with the final value is 3,080.

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