



Decision Support System in the Best Selection Coffee Shop with TOPSIS Method

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Abstract—The development of business opportunities in today's era brings many benefits as well as in coffee shops. Coffee Shop is a place to relax or gather with friends, family to release boredom, after daily activities, and Coffee shop enthusiasts are quite well known both from teenagers to parents, where coffee shop fans must have an ability to visit the coffee shop. This research has a goal to generate a decision support system (DSS). Which is where the decision support system (DSS) has utility as a tool to make the best coffee shop decisions overall. By setting the TOPSIS (Technique For Order Preference By Similarity To Ideal Solution) method by getting the preference value as the first rank. So with this, the best coffee shop is found in alternative A04 with the highest score of 0.9911 on behalf of Arata Coffee

Keywords: Coffee Shop; Best Selection; DSS; TOPSIS Method

1. INTRODUCTION

The business that is developing the most rapidly and can be estimated as one of the most profitable in today's developing era is the Coffee Shop business. Coffee Shop is a place to relax or gather with friends and family to relieve boredom after daily activities[1]. We can see that coffee shops are widely spread in big cities in Indonesia and coffee shop enthusiasts are quite well known, from teenagers to parents, where coffee shop fans must have the ability to visit coffee shops.[1]

In wanting to visit the coffee shop itself, there are several main problems that must be faced, one of these problems is opening too many coffee shop businesses, so that consumers or coffee fans are too confused in choosing a coffee place to relax. In solving the problem above, a criterion is needed, where the criteria are price, service, taste, facilities, and location. After getting the existing criteria, it is necessary to have a system. The system used is a decision support system capable of dealing with real problems[2].

A decision support system is a computer-based system that has alternative decisions in helping various problems using the data and methods that will be used [3]. In implementing the decision support system, there are several methods used in making a decision, so that the decision becomes very effective and accurate, including the TOPSIS method (Technique For Order Preference By Similarity To Ideal Solution). TOPSIS (Technique For Order Preference By Similarity To Ideal Solution) is one of the decision makers that has the selected alternative and has the shortest or longest distance according to the ideal solution. In this study the authors chose the TOPSIS method (Technique For Order Preference By Similarity To Ideal Solution) in which this method will show effective calculation results, so that the results to be obtained can be used as a tool for determining the best coffee shop[4].

Previous research conducted by Titin Kristiana in 2018 discussed the "Decision Support System using the TOPSIS method for Selecting Locations for Wholesale Credit Establishments". This study has 5 criteria including, strategic location, population density around the location, people's income, close to public facilities, and a supportive level of security. After getting the criteria and alternatives, the writer can conclude that the highest score is obtained from A2 Kutabumi with a value of 0.666[5]. Research conducted by Amelia Nur Fitriana et al in 2015 discussed the "Decision Support System for Determining Student Academic Achievement with the TOPSIS Method". In this research, there are 6 criteria, namely memorization of the Koran, average score, minimum score, number of attendance, total score, and certificate of achievement. After obtaining the criteria, the authors concluded that the highest score was obtained by Wildan with a value of 0.66. Furthermore, research conducted by Gunawan Wibisono et al in 2019 discussed "Application of the TOPSIS Method in Determining the Best Lecturers". In this study there are 5 criteria including the following[6], length of service, Achievement, Teaching, Research, and Service. So the writer can conclude that the highest score from this article goes to DZN with a score of 23.95.

Furthermore, research conducted by Marlina et al in 2017 discussed the "Decision Support System for Selection of Students Eligible for Scholarships Using the TOPSIS Method". In this study there were 5 criteria including the following, Report Score, File Completeness, TPA Test, Student Interviews and Parent Interviews. So the authors can conclude that the highest score is obtained from V5 with a value of 0.618909054. Furthermore, research conducted by Mestiana Elprida Marpaung and Anita Sindar RMS in 2018 discussed "Assessing the Best Teachers of SMP Tri Sakti

Lubuk Pakam Using the TOPSIS Method". This study has 4 criteria including the following, Service Orientation/Education Management, Integrity/honesty, commitment/consistency, and cooperation/leadership. After getting the criteria, the writer can conclude that the highest result from this article is preference V4 with a value of 0.440[7].

2. RESEARCH METHODOLOGY

2.1 Coffee Shop

Coffee Shop is a place for business in serving food as well as a gathering place for both young and old people as a place to discuss and spend time when they are tired of working, doing activities and studying. Especially for today's teenagers who are currently in a trend with the name nongki or hanging out. Therefore the coffee shop is the most important place for all people because it has a different place and atmosphere[8].

2.2 Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) Method

TOPSIS (Technique For Order Preference By Similarity To Ideal Solution) is a multi-criteria decision-making method where the basis is on the concept or choosing the best alternative and where the alternative has the shortest/longest distance and there is a positive or negative ideal solution.[9]–[13].

In the TOPSIS method there are (5) ways or steps that are useful in solving and solving problems that occur, namely:

1. Determine the alternatives and criteria that will be taken into account using the topsis method
2. Determine the normalized decision matrix using the following formula [14], [15]:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^m x_{ij}^2}} \quad (1)$$

3. Calculating Weighted Normalization.

$$y_{ij} = w_i r_{ij} \quad (2)$$

4. Determine the matrix of positive and negative ideal solutions.

Under the condition :

- a. The lowest criterion value

$$A^- = (y_1^-, y_2^- \dots y_n^-) \quad (3)$$

- b. If the criteria are high

$$A^+ = (y_1^+, y_2^+ \dots y_n^+) \quad (4)$$

5. Calculate the ideal distance.

- a. If the ideal solution is positive,

$$D_i^+ = \sqrt{\sum_{j=1}^n (y_1^+ - y_{ij})^2} \quad (5)$$

- b. If the ideal solution is negative,

$$D_i^- = \sqrt{\sum_{j=1}^n (y_{ij} - y_1^-)^2} \quad (6)$$

6. Calculating preferences

$$v_i = \frac{D_i^-}{D_i^- + D_i^+} \quad (7)$$

2.3 Research Stages

There are several stages of research in making this article as follows [16]:

1. Problem Identification

When conducting a research we first analyze the problem so that we can make it the main problem in a research.

2. Data collection

At this stage the author can collect data that is very necessary because it can be used as a reference. data collection can be in the form of interviews and observations

3. Literature study

In conducting research, the writer must understand an object and look for some references that can be taken from Google School or from the library.

4. Analysis and application of the method

At this stage we analyze the problem in determining the Best Coffee Shop using the TOPSIS method

In this study, we can analyze the problem in determining the best coffee shop starting from proving the value of the criteria and alternative weights using the TOPSIS method, based on the steps above can be seen in Figure 1 below.

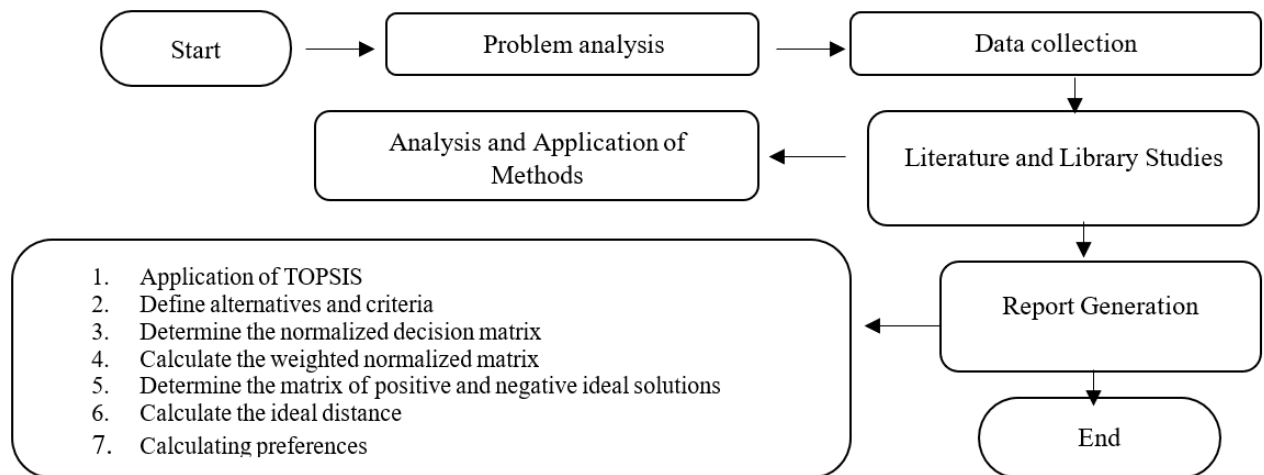


Figure 1. Research Stages

3. RESULT AND DISCUSSION

3.1 Determination of Alternatives and Criteria

Furthermore, in realizing the decision, it is necessary to have a process of determining the best coffee shop, it requires data on several alternative data and criteria, so that these needs can be seen from tables 1 and 2 below. The following are 5 coffee shop criteria data as shown in table 1 below:

Table 1. Alternative Data

Code	Alternative
A01	Coffee Shop 1
A02	Coffee Shop 2
A03	Coffee Shop 3
A04	Coffee Shop 4
A05	Coffee Shop 5

Table 2 below is the criteria data used in the study.

Table 2. Criteria Data

Criteria	Information	Weight	Type
C1	Price	31%	Benefit
C2	Service	24%	Benefit
C3	Falvor	19%	Benefit
C4	Facility	16%	Benefit
C5	Location	10%	Benefit

The following table 3 is the suitability rating data of the problems that will be examined in determining the best coffee shop.

Table 3. Alternatives and Criteria

Alternative	Price	Service	Flavor	Facility	Location
A01	45.00	Baik	Sangat Baik	Baik	Jauh
A02	30.00	Sangat Baik	Cukup	Sangat Baik	Cukup Jauh
A03	25.00	Cukup	Baik	Cukup	Sangat Jauh
A04	50.00	Sangat Baik	Baik	Cukup	Cukup jauh
A05	35.00	Cukup	Sangat Baik	Sangat Baik	Jauh

In the data shown in table 3 there is still data of a linguistic type, so it is necessary to weight the data. Tables 4 and 5 are needed in the weighting of linguistic data.

Table 4. C2, C3, and C4 weight data

Score	Information
5	Very good
4	Good
3	Pretty good

Table 5. Weight Data C5

Score	Information
5	Very good
4	Good
3	Pretty good

The results of weighting the data in table 3 based on table 4 and table 5, the match rating data is obtained as shown in table 6 as follows.

Table 6. Match Rating Data

Alternative	C1	C2	C3	C4	C5
A01	45.00	4	5	4	4
A02	30.00	5	3	5	3
A03	25.00	3	4	3	5
A04	50.00	5	4	3	3
A05	35.00	3	5	5	4

3.2 Implementation of the TOPSIS Method

The following are the stages of testing the TOPSIS method in determining the best Coffee Shop.

1. Determine the normalized decision matrix

$$|X1| = \sqrt{40.00^2 + 30.00^2 + 25.00^2 + 50.00^2 + 35.00^2} = 1.2369$$

$$X_{11} = \frac{40.00}{1.2369} = 32.3389$$

$$X_{12} = \frac{30.00}{1.2369} = 24.2541$$

$$X_{13} = \frac{25.00}{1.2369} = 20.2118$$

$$X_{14} = \frac{50.00}{1.2369} = 40.4236$$

$$X_{15} = \frac{35.00}{1.2369} = 28.2965$$

$$|X2| = \sqrt{4^2 + 5^2 + 3^2 + 5^2 + 3^2} = 9.1651$$

$$X_{21} = \frac{4}{9.1651} = 0.4364$$

$$X_{22} = \frac{5}{9.1651} = 0.5455$$

$$X_{23} = \frac{3}{9.1651} = 0.3273$$

$$X_{24} = \frac{5}{9.1651} = 0.5455$$

$$X_{25} = \frac{3}{9.1651} = 0.3273$$

$$|X3| = \sqrt{5^2 + 3^2 + 4^2 + 4^2 + 5^2} = 9.5393$$

$$X_{31} = \frac{5}{9.5393} = 0.5241$$

$$X_{32} = \frac{3}{9.5393} = 0.3144$$

$$X_{33} = \frac{4}{9.5393} = 0.4193$$

$$X_{34} = \frac{4}{9.5393} = 0.4193$$

$$X_{35} = \frac{5}{9.5393} = 0.5241$$

$$|X4| = \sqrt{4^2 + 5^2 + 3^2 + 3^2 + 5^2} = 9.1651$$

$$X_{41} = \frac{4}{9.1651} = 0.4364$$

$$X_{42} = \frac{5}{9.1651} = 0.5455$$

$$X_{43} = \frac{3}{9.1651} = 0.3273$$

$$X_{44} = \frac{3}{9.1651} = 0.3273$$

$$X_{45} = \frac{5}{9.1651} = 0.5455$$

$$|X5| = \sqrt{4^2 + 3^2 + 5^2 + 3^2 + 4^2} = 8.6602$$

$$X_{51} = \frac{4}{8.6602} = 0.4618$$

$$X_{52} = \frac{3}{8.6602} = 0.3464$$

$$X_{53} = \frac{5}{8.6602} = 0.5773$$

$$X_{54} = \frac{3}{8.6602} = 0.3464$$

$$X_{55} = \frac{4}{8.6602} = 0.4618$$

The matrix formed by the normalization calculation results above is:

$$R = \begin{bmatrix} 32.3389 & 0.4364 & 0.5241 & 0.4364 & 0.4618 \\ 24.2541 & 0.5455 & 0.3144 & 0.5455 & 0.3464 \\ 20.2118 & 0.3273 & 0.4193 & 0.3273 & 0.5773 \\ 40.4236 & 0.5455 & 0.4193 & 0.3273 & 0.3464 \\ 28.2965 & 0.3273 & 0.5241 & 0.5455 & 0.4618 \end{bmatrix}$$

In the next stage, it is carried out by multiplying the results of r with the weight value

$$Y = \begin{bmatrix} 0.31 * 32.3389 & 0.24 * 0.4364 & 0.19 * 0.5241 & 0.16 * 0.4364 & 0.1 * 0.4618 \\ 0.31 * 24.2541 & 0.24 * 0.5455 & 0.19 * 0.3144 & 0.16 * 0.5455 & 0.1 * 0.3464 \\ 0.31 * 20.2118 & 0.24 * 0.3273 & 0.19 * 0.4193 & 0.16 * 0.3273 & 0.1 * 0.5773 \\ 0.31 * 40.4236 & 0.24 * 0.5455 & 0.19 * 0.4193 & 0.16 * 0.3273 & 0.1 * 0.3464 \\ 0.31 * 28.2965 & 0.24 * 0.3273 & 0.19 * 0.5241 & 0.16 * 0.5455 & 0.1 * 0.4618 \end{bmatrix}$$

$$Y = \begin{bmatrix} 10.0250 & 0.1047 & 0.0995 & 0.0698 & 0.0461 \\ 7.5187 & 0.1309 & 0.0597 & 0.0872 & 0.0346 \\ 6.2656 & 0.0785 & 0.0796 & 0.0523 & 0.0577 \\ 12.5313 & 0.1309 & 0.0796 & 0.0523 & 0.0346 \\ 8.7719 & 0.0785 & 0.0995 & 0.0872 & 0.0461 \end{bmatrix}$$

Next, a positive ideal value is selected, namely the highest value that has an alternative and a negative ideal value, which is the lowest value, and the results are as follows [17]:

Table 7. Positive and negative ideal values

C1	C2	C3	C4	C5
10.0250	0.1047	0.0995	0.0698	0.0461
7.5187	0.1309	0.0597	0.0872	0.0346
6.2656	0.0785	0.0796	0.0523	0.0577

	C1	C2	C3	C4	C5
	12.5313	0.1309	0.0796	0.0523	0.0346
	8.7719	0.0785	0.0995	0.0872	0.0461
y^+	12.5313	0.1309	0.0995	0.0872	0.0577
y^-	7.5187	0.0785	0.0597	0.0523	0.0346

Then calculate the value of D+ and D- in the following way:

$$D_1^+ = \sqrt{(10.0250 - 12.5313)^2 + (0.1047 - 0.1309)^2 + (0.0995 - 0.0995)^2 + (0.0698 - 0.0872)^2 + (0.0461 - 0.0577)^2} = 2.5064$$

$$D_2^+ = \sqrt{(7.5187 - 12.5313)^2 + (0.1309 - 0.1309)^2 + (0.0597 - 0.0995)^2 + (0.0872 - 0.0872)^2 + (0.0346 - 0.0577)^2} = 5.0127$$

$$D_3^+ = \sqrt{(6.2656 - 12.5313)^2 + (0.0785 - 0.1309)^2 + (0.0796 - 0.0995)^2 + (0.0523 - 0.0872)^2 + (0.0577 - 0.0577)^2} = 6.2657$$

$$D_4^+ = \sqrt{(12.5313 - 12.5313)^2 + (0.1309 - 0.1309)^2 + (0.0796 - 0.0995)^2 + (0.0523 - 0.0872)^2 + (0.0346 - 0.0577)^2} = 0.0447$$

$$D_5^+ = \sqrt{(8.7719 - 12.5313)^2 + (0.0785 - 0.1309)^2 + (0.0995 - 0.0995)^2 + (0.0872 - 0.0872)^2 + (0.0461 - 0.0577)^2} = 3.7597$$

For the value of D- obtained as follows:

$$D_1^- = \sqrt{(10.0250 - 7.5187)^2 + (0.1047 - 0.0785)^2 + (0.0995 - 0.0597)^2 + (0.0698 - 0.0523)^2 + (0.0461 - 0.0346)^2} = 2.5067$$

$$D_2^- = \sqrt{(7.5187 - 7.5187)^2 + (0.1309 - 0.0785)^2 + (0.0597 - 0.0597)^2 + (0.0872 - 0.0523)^2 + (0.0346 - 0.0346)^2} = 0.0624$$

$$D_3^- = \sqrt{(6.2656 - 7.5187)^2 + (0.0785 - 0.0785)^2 + (0.0796 - 0.0597)^2 + (0.0523 - 0.0523)^2 + (0.0577 - 0.0346)^2} = 1.2533$$

$$D_4^- = \sqrt{(12.5313 - 7.5187)^2 + (0.1309 - 0.0785)^2 + (0.0995 - 0.0597)^2 + (0.0523 - 0.0523)^2 + (0.0346 - 0.0346)^2} = 5.0128$$

$$D_5^- = \sqrt{(8.7719 - 7.5187)^2 + (0.0785 - 0.0785)^2 + (0.0995 - 0.0597)^2 + (0.0872 - 0.0523)^2 + (0.0461 - 0.0346)^2} = 1.2543$$

The final stage is to calculate the reference value in order to get the best value:

$$V_1 = \frac{2.5067}{2.5067+2.5064} = 0.5000$$

$$V_2 = \frac{0.0624}{0.0624+5.0127} = 0.0122$$

$$V_3 = \frac{1.2533}{1.2533+6.2657} = 0.1666$$

$$V_4 = \frac{5.0128}{5.0128+0.0447} = 0.9911$$

$$V_5 = \frac{1.2543}{1.2543+3.7597} = 0.2502$$

From the calculation of the last stages above, the final ranking results table 8, that which gets the first rank is on alternative data to A04 with a value of 0.9911.

Table 8. Final ranking results

Alternative	Name	Score	Rank
A01	Coffee Shop 1	0.5000	2
A02	Coffee Shop 2	0.0122	5
A03	Coffee Shop 3	0.1666	4
A04	Coffee Shop 4	0.9911	1
A05	Coffee Shop 5	0.2502	3

4. CONCLUSION

In this research, in the process of determining the best coffee shop by applying the understanding of the TOPSIS method and using predetermined criteria so as to obtain a very effective stage. The results of the calculation to get the best coffee shop is A04 with the highest score of 0.9911 as the best alternative. The process and results of the selection of the system which can be used as an election or recommendation in taking a decision step, so that the decisions made by the author are more accurate and precise.

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