

Decision Support System for Determining New Branch Location Applying the MAUT Method with ROC Weighting

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Abstract

The new branch location is close to people's activities with the availability of adequate facilities, making it convenient for consumers to access the services/products they need. The determination of the feasibility of a new branch location by several product or service producers still uses an inaccurate system, which can lead to problems in determining a strategic and targeted new branch location. However, there are some challenges in selecting a new branch location, so the utilization of technology is considered efficient, easy, and flexible, widely used by entrepreneurs, especially in determining new branch locations. This is done by using the assistance of a decision support system, which is expected to help determine an efficient and strategic new branch location. The aid comes in the form of a Decision Support System using the MAUT method with ROC weighting. After calculating each criterion and alternative, the best ranking is obtained for alternative A6 with a value of 0.6847. This way, business groups will not have difficulty in determining a new branch location through alternatives and criteria. The use of the MAUT method with ROC weighting is expected to assist in obtaining the best and valid alternatives up to the ranking stage.

Keywords: DSS; New Branch Location; MAUT Method; ROC Method

1. INTRODUCTION

In the scope of the marketing world, the location of a new branch is usually proposed to meet the relatively high demand where a producer or entrepreneur is required to fulfill consumer demand. The new branch location, which is close to people's activities with the availability of adequate facilities, makes it convenient for consumers to access the services/products they need. The determination of the feasibility of a new branch location by several product or service producers still uses an inaccurate system, which can lead to problems in determining a strategic and targeted new branch location. This is expected to help increase profits and benefits from the addition of a new branch location for the business[1].

The determination of a new branch location to be opened is conducted through research first to determine the advantages of each allocation that becomes its choice, starting from the surrounding environmental conditions, competitors, and good and strategic location conditions, considered to be most influential in a business in generating benefits or profits and can be expected to achieve a business goal. The determination of a new branch location currently often utilizes technological assistance in determining locations, analyzing products, marketing management, and other things related to the development of ongoing business. The utilization of technology is considered efficient, easy, and flexible, widely used by entrepreneurs, especially in determining new branch locations, using the assistance of a decision support system, which is expected to help determine an efficient and strategic new branch location.

The decision support system is a conclusion and determination-making process that uses several accurate data and computerized testing in each criterion to obtain valid results[2]–[4]. There are several types of decision support systems, including Step-wise Weight Assessment Ratio Analysis Method (SWARA), Rank Order Centroid (ROC), Preference Selection Index (PSI), Multi-Attributive Border Approximation area Comparison (MABAC), Multi-Attribut Utility Theory (MAUT), Additive Ratio Assessment (ARAS), Preference Ranking Organization Method For Enrichment Evaluation (PROMETHEE I-II-III), ELECTREE I-II-III, EXPROM I & II. In this study, the author can solve a problem using the MAUT and ROC methods. MAUT is a quantitative comparison method used as the basis for decision-making based on a systematic way of identifying and analyzing data, while ROC is used to determine the best results and weighting[5]–[6].

The benchmark for this research is based on previous research that used the same method, conducted in 2021 by Ronny Addenan, et al., using the ROC and ARAS methods in recommending suppliers and obtaining the best alternative 0.8017[7]. Research in 2022 conducted by Wahyu Harry Bai Lumban Batu, et al., in determining football player transfers using the ROC and MAUT methods, resulting in the best alternative, A1 for Cristiano Ronaldo with a value of 0.587[8]. Research in 2022 by Jumba Dorisman Rajagukguk, et al., in determining prospective tuition fee assistance at Budi Darma University using the ROC and MAUT methods resulted in the best ranking, namely Nur Sekartika A1 0.707[9]. Research in 2022 by Dimas Hadityo Ramadan, et al., in the application of the MAUT method for determining the feasibility of Indonesian migrant workers with ROC weighting, the best alternative is alternative A5 named "Boby" with a value of $U_i = 0.9748$ [10]. Research conducted in 2022 by Zaza Mutiara Arini, et al., in determining the best facial wash for oily skin using the MAUT method with ROC resulted in the best ranking with a value of 0.7775 A2 Ponds[11]. Therefore, the author is interested in using a method by combining MAUT to obtain the best preference value by applying ROC in determining a new branch location.

The author conducted this research to make decisions on weight values and the best preferences in determining a new branch location. This way, business groups will not have difficulty in determining a new branch location through alternatives and criteria. The use of the MAUT method with ROC weighting is expected to assist in obtaining the best and valid alternatives up to the ranking stage.

2. RESEARCH METHODOLOGY

2.1 Decision Support System

A Decision Support System is a computerized program implementation system used in problem-solving to provide the best decisions, widely used by companies or groups to obtain optimal solutions. There are several methods that can be used in DSS, such as SAW, MOORA, TOPSIS, PSI[12]–[14].

2.2 New Branch Location

Location is a place where a specific group displays or markets products or services for common goals and interests. The implementation of a new branch is aimed at increasing the profits of a company or group due to market demands for the provision of services or products, making it easier for consumers in economic aspects[15].

2.3 Rank Order Centroid Method

The ROC method is useful in obtaining criteria with weighting values based on priorities. Determining the highest result is more important than other values. To obtain weight values using the ROC method, it can be seen in the equation below[16]–[20]:

$$w_m = \frac{1}{m} \sum_{i=1}^m \left(\frac{1}{i} \right) \quad (1)$$

Thus, the result of w_m is equal to 1.

2.4 Multi-Attribut Utility Theory (MAUT) Method

The MAUT method is a comparison that combines different risks and criteria to provide a solution. The MAUT method also outlines the problem by transforming several criteria into values or numbers on a scale of 0-1, with 0 being the worst and 3-1 being the best[21]–[25].

1. Preparing Decision Matrix

$$X_{ij} = \begin{bmatrix} r_{11} & \cdots & r_{1j} & \cdots & r_{1n} \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ r_{i1} & \cdots & r_{ij} & \cdots & r_{in} \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ r_{m1} & \cdots & r_{mj} & \cdots & r_{mn} \end{bmatrix}; i = 1, \dots, m, j = 1, \dots, n \quad (2)$$

2. Calculating Normalization Matrix (r_{ij}^*)

For Benefit criteria:

$$(r_{ij}^*) = \frac{r_{ij} - \min(r_{ij})}{\max(r_{ij}) - \min(r_{ij})} \quad (3)$$

For Cost criteria:

$$r_{ij}^* = 1 + \left(\frac{\min(r_{ij}) - r_{ij}}{\max(r_{ij}) - \min(r_{ij})} \right) \quad (4)$$

3. Calculating Marginal Utility Values (u_{ij})

$$u_{ij} = \frac{e^{(r_{ij}^*)^2} - 1}{1,71} \quad (5)$$

4. Calculating Final Utility Values (Preference Value)

$$U_i = \sum_{j=1}^n u_{ij} \cdot w_j \quad (6)$$

2.5 Research Stages

In conducting this research, several stages were carried out by the author. Here is an explanation of the various research stages:

1. Problem Analysis

Solving problems by analyzing data and facts before conducting calculations.

2. Data Collection

- Conducting targeted research to obtain valid data in determining the best location for a new branch.
3. Literature Review
Beneficial for the author in the stage of applying similar MAUT methods to obtain references.
 4. Implementation of MAUT and ROC Methods
Implementing the ROC and MAUT methods in the process of calculating sample data.
 5. Research Report
Creating a research report as a written result in the form of a summary of this research.

The research stages above are depicted in full in Figure 1 below:

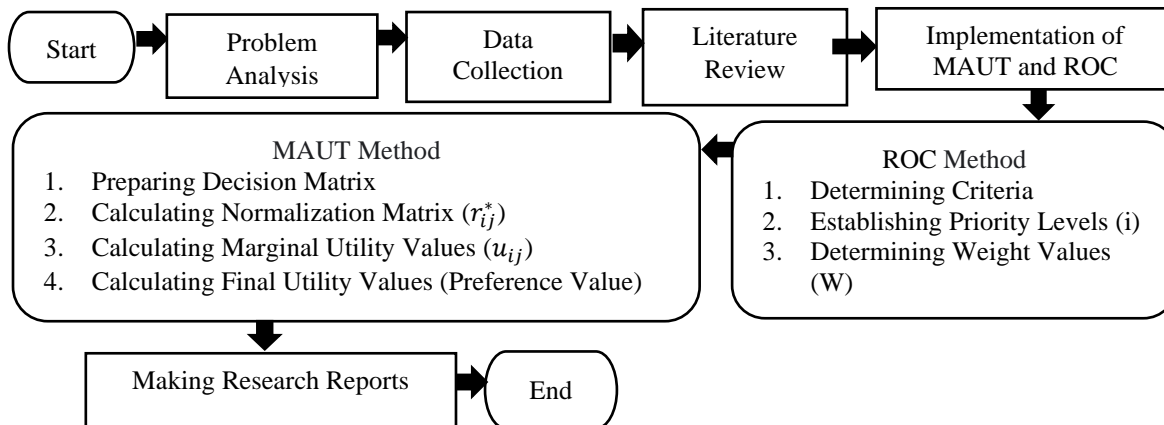


Figure 1. Research Stages

3. RESULTS AND DISCUSSION

To obtain a decision regarding the selection of a new branch location by implementing the MAUT Method as a solution to the problem, the author performed calculations using the method as outlined below.

3.1 Determination of Alternatives and Criteria

The determination of alternatives in the selection of a strategic location is clearly outlined in Table 1 below:

Table 1. Alternative Data

Alternative	Location Name
A ₁	Sultan Serdang Street
A ₂	Lubuk Pakam Street
A ₃	Limau Manis Street
A ₄	Bt. Kuis Street
A ₅	Kapten Muslim Street
A ₆	Wonosari Street
A ₇	Kualanamu Street

In the selection of a strategic location, there are criteria needed as outlined in Table 2 below:

Table 2. Criterion Data

Criteria	Description	Type
C ₁	Efficient Location	Benefit
C ₂	Area Size	Benefit
C ₃	Easy Accessibility	Benefit
C ₄	Crowd Density	Benefit
C ₅	Number of Competitors	Cost
C ₆	Rental Price	Cost
C ₇	Lease Duration	Cost

Explanation of criteria in Table 2:

- Efficient Location : location that is advantageous and influences business progress.
- Area Size : The size of the land area based on length and width.
- Easy Accessibility : Ease of access that can be reached by consumers to the business location.
- Crowd Density : Conditions that create a frequently visited situation.
- Number of Competitors : The number of business competitors located near the site.

Rental Price : The total cost to be paid as per the agreement.
 Lease Duration : The agreed-upon duration between the parties.

3.2 Determination of Weights Using the ROC Method

In the selection of a new branch location, the criteria stage must include the process of weighting calculations. ROC for the required weighting in the ranking of alternative values. The elaboration process of weight values using Equation 1 in the ROC method can be clearly seen in the calculations below:

$$W_1 = \frac{1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5} + \frac{1}{6} + \frac{1}{7}}{7} = 0,37$$

$$W_2 = \frac{0 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5} + \frac{1}{6} + \frac{1}{7}}{7} = 0,23$$

$$W_3 = \frac{0 + 0 + \frac{1}{3} + \frac{1}{4} + \frac{1}{5} + \frac{1}{6} + \frac{1}{7}}{7} = 0,16$$

$$W_4 = \frac{0 + 0 + 0 + \frac{1}{4} + \frac{1}{5} + \frac{1}{6} + \frac{1}{7}}{7} = 0,11$$

$$W_5 = \frac{0 + 0 + 0 + 0 + \frac{1}{5} + \frac{1}{6} + \frac{1}{7}}{7} = 0,07$$

$$W_6 = \frac{0 + 0 + 0 + 0 + 0 + \frac{1}{6} + \frac{1}{7}}{7} = 0,04$$

$$W_7 = \frac{0 + 0 + 0 + 0 + 0 + 0 + \frac{1}{7}}{7} = 0,02$$

So, the weighting for C_1 is 0.37, C_2 with a value of 0.23, C_3 with a value of 0.16, C_4 with a value of 0.11, C_5 with a value of 0.07, C_6 with a value of 0.04, and C_7 with a value of 0.02. The weight values and criteria are shown below in table 3:

Table 3. Weight Values and Criteria

Criteria	Description	Weight	Type
C_1	Efficient Location	0.37	Benefit
C_2	Area Size	0.23	Benefit
C_3	Easy Accessibility	0.16	Benefit
C_4	Crowd Density	0.11	Benefit
C_5	Number of Competitors	0.07	Cost
C_6	Rental Price	0.04	Cost
C_7	Lease Duration	0.02	Cost

Below are the necessary location data for the selection of a strategic location.

Table 4. Alternative and Criteria Data

Alternative	C_1	C_2	C_3	C_4	C_5	C_6	C_7
A ₁	Very Efficient	1500	Very easy	Crowded	15	18000000	4
A ₂	Not efficient	500	Difficult	Not Crowded	12	15000000	2
A ₃	Efficient	800	Quite easy	Very Crowded	10	11000000	3
A ₄	Less efficient	600	Difficult	Quite Crowded	8	10000000	2
A ₅	Not efficient	200	Easy	Crowded	9	8000000	1
A ₆	Very Efficient	400	Very easy	Very Crowded	7	12000000	5
A ₇	Less efficient	300	Easy	Not Crowded	13	13000000	2

In the table 4, there is still linguistic data, so it requires weighting to produce numerical values as seen in Table 5, Table 6, and Table 7 below:

Table 5. Weight Values for Efficient Location (C_1)

Description	Weight
Very Efficient	4
Efficient	3
Less Efficient	2
Not Efficient	1

Table 6. Weight Values for Easy Accessibility (C_3)

Description	Weight
Very easy	4
Easy	3
Quite easy	2
Difficult	1

Table 7. Weight Values for Crowd Density (C_4)

Description	Weight
Very Crowded	4
Crowded	3
Quite Crowded	2
Not Crowded	1

The criteria that have been weighted can be clearly seen in Table 8 below:

Table 8. Compatibility Rating Data After Weighting

Alternative	C_1	C_2	C_3	C_4	C_5	C_6	C_7
A_1	3	1000	2	4	15000000	11	3
A_2	2	800	3	2	7000000	12	1
A_3	1	500	4	3	12000000	13	2
A_4	4	700	2	4	11000000	14	4
A_5	2	400	1	1	8000000	11	5
A_6	2	300	3	1	10000000	15	1
A_7	4	900	4	2	14000000	9	3

3.3 Implementation of MAUT Method

The stages of the calculation process applying the MAUT method in strategic location selection are explained in detail in the following steps:

1. Preparing the Decision Matrix

$$X_{ij} = \begin{bmatrix} 3 & 1000 & 2 & 4 & 15000000 & 12 & 3 \\ 2 & 800 & 3 & 2 & 7000000 & 14 & 1 \\ 1 & 500 & 4 & 3 & 12000000 & 13 & 2 \\ 4 & 700 & 2 & 4 & 11000000 & 10 & 4 \\ 2 & 400 & 1 & 1 & 8000000 & 11 & 5 \\ 2 & 300 & 3 & 1 & 10000000 & 15 & 1 \\ 4 & 900 & 4 & 2 & 14000000 & 9 & 3 \end{bmatrix}$$

2. Calculating the Normalization Matrix (r_{ij}^*)

For Criterion C_1 (Benefit)

$$r_{11}^* = \frac{3-1}{4-1} = 0.66$$

$$r_{21}^* = \frac{2-1}{4-1} = 0.33$$

$$r_{31}^* = \frac{1-1}{4-1} = 0$$

$$r_{41}^* = \frac{4-1}{4-1} = 1$$

$$r_{51}^* = \frac{2-1}{4-1} = 0.33$$

$$r_{61}^* = \frac{2-1}{4-1} = 0.33$$

$$r_{71}^* = \frac{4-1}{4-1} = 1$$

For Criterion C_2 (Benefit)

$$r_{12}^* = \frac{1000-300}{1000-300} = 1$$

$$r_{22}^* = \frac{800-300}{1000-300} = 0.71$$

$$r_{32}^* = \frac{500-300}{1000-300} = 0.28$$

$$r_{42}^* = \frac{700-300}{1000-300} = 0.57$$

$$r_{52}^* = \frac{400-300}{1000-300} = 0.14$$

$$r_{62}^* = \frac{300-300}{1000-300} = 0$$

$$r_{72}^* = \frac{900-300}{1000-300} = 0.85$$

For Criterion C_3 (Benefit)

$$r_{13}^* = \frac{2-1}{4-1} = 0.33$$

$$r_{23}^* = \frac{3-1}{4-1} = 0.66$$

$$r_{33}^* = \frac{4-1}{4-1} = 1$$

$$r_{43}^* = \frac{4-1}{2-1} = 0.33$$

$$r_{53}^* = \frac{4-1}{1-1} = 0$$

$$r_{63}^* = \frac{4-1}{3-1} = 0.66$$

$$r_{73}^* = \frac{4-1}{4-1} = 1$$

For Criterion C_4 (Benefit)

$$r_{14}^* = \frac{4-1}{4-1} = 1$$

$$r_{24}^* = \frac{4-1}{2-1} = 0.33$$

$$r_{34}^* = \frac{4-1}{3-1} = 0.66$$

$$r_{44}^* = \frac{4-1}{4-1} = 1$$

$$r_{54}^* = \frac{4-1}{1-1} = 0$$

$$r_{64}^* = \frac{4-1}{4-1} = 0$$

$$r_{74}^* = \frac{4-1}{2-1} = 0.33$$

For Criterion C_5 (Cost)

$$r_{15}^* = 1 + \frac{7000000-15000000}{15000000-7000000} = 1$$

$$r_{25}^* = 1 + \frac{7000000-7000000}{7000000-7000000} = 0$$

$$r_{35}^* = 1 + \frac{15000000-7000000}{7000000-12000000} = 0.62$$

$$r_{45}^* = 1 + \frac{15000000-7000000}{7000000-11000000} = 0.5$$

$$r_{55}^* = 1 + \frac{15000000-7000000}{7000000-8000000} = 0.12$$

$$r_{65}^* = 1 + \frac{15000000-7000000}{7000000-10000000} = 0.37$$

$$r_{75}^* = 1 + \frac{15000000-7000000}{7000000-14000000} = 0.87$$

For Criterion C_6 (Cost)

$$r_{16}^* = 1 + \frac{9-12}{15-9} = 0.5$$

$$r_{26}^* = 1 + \frac{9-14}{15-9} = 0.16$$

$$r_{36}^* = 1 + \frac{9-13}{15-9} = 0.33$$

$$r_{46}^* = 1 + \frac{9-10}{15-9} = 0.83$$

$$r_{56}^* = 1 + \frac{9-11}{15-9} = 0.66$$

$$r_{66}^* = 1 + \frac{9-15}{15-9} = 0$$

$$r_{76}^* = 1 + \frac{9-9}{15-9} = 1$$

For Criterion C_7 (Cost)

$$r_{17}^* = 1 + \frac{1-3}{5-1} = 0.5$$

$$r_{27}^* = 1 + \frac{1-1}{5-1} = 1$$

$$r_{37}^* = 1 + \frac{1-2}{5-1} = 0.75$$

$$r_{47}^* = 1 + \frac{1-4}{5-1} = 0.25$$

$$r_{57}^* = 1 + \frac{1-5}{5-1} = 0$$

$$r_{67}^* = 1 + \frac{1-1}{5-1} = 1$$

$$r_{77}^* = 1 + \frac{1-3}{5-1} = 0.5$$

After completing the normalization matrix calculations for all criteria, it will result in the following table 9 of normalized matrices.

Table 9. Normalized Matrix Results

Alternative	C ₁	C ₂	C ₃	C ₄	C ₅	C ₆	C ₇
A ₁	0.66	1	0.33	1	1	0.5	0.5
A ₂	0.33	0.71	0.66	0.33	0	0.16	1
A ₃	0	0.28	1	0.66	0.62	0.33	0.75
A ₄	1	0.57	0.33	1	0.5	0.83	0.25
A ₅	0.33	0.14	0	0	0.12	0.66	0
A ₆	0.33	0	0.66	0	0.37	0	1
A ₇	1	0.85	1	0.33	0.87	1	0.5

3. Calculating Marginal Utility Values (U_{ij})

For Criterion C₁

$$U_{11} = \frac{e^{(0.66)^2} - 1}{1.71} = 0.32$$

$$U_{21} = \frac{e^{(0.33)^2} - 1}{1.71} = 0.07$$

$$U_{31} = \frac{e^{(0)^2} - 1}{1.71} = 0$$

$$U_{41} = \frac{e^{(1)^2} - 1}{1.71} = 1$$

$$U_{51} = \frac{e^{(0.33)^2} - 1}{1.71} = 0.07$$

$$U_{61} = \frac{e^{(0.33)^2} - 1}{1.71} = 0.07$$

$$U_{71} = \frac{e^{(1)^2} - 1}{1.71} = 1$$

For Criterion C₂

$$U_{12} = \frac{e^{(1)^2} - 1}{1.71} = 1$$

$$U_{22} = \frac{e^{(0.71)^2} - 1}{1.71} = 0.38$$

$$U_{32} = \frac{e^{(0.28)^2} - 1}{1.71} = 0.05$$

$$U_{42} = \frac{e^{(0.57)^2} - 1}{1.71} = 0.25$$

$$U_{52} = \frac{e^{(0.14)^2} - 1}{1.71} = 0.01$$

$$U_{62} = \frac{e^{(0)^2} - 1}{1.71} = 0$$

$$U_{72} = \frac{e^{(0.85)^2} - 1}{1.71} = 0.13$$

For Criterion C₃

$$U_{13} = \frac{e^{(0.33)^2} - 1}{1.71} = 0.07$$

$$U_{23} = \frac{e^{(0.66)^2} - 1}{1.71} = 0.32$$

$$U_{33} = \frac{e^{(1)^2} - 1}{1.71} = 1$$

$$U_{43} = \frac{e^{(0.33)^2} - 1}{1.71} = 0.07$$

$$U_{53} = \frac{e^{(0)^2} - 1}{1.71} = 0$$

$$U_{63} = \frac{e^{(10.66)^2} - 1}{1.71} = 0.32$$

$$U_{73} = \frac{e^{(1)^2} - 1}{1.71} = 1$$

For Criterion C₄

$$U_{14} = \frac{e^{(1)^2} - 1}{1.71} = 1$$

$$U_{24} = \frac{e^{(0.33)^2} - 1}{1.71} = 0.08$$

$$U_{34} = \frac{e^{(0.66)^2} - 1}{1.71} = 0.32$$

$$U_{44} = \frac{e^{(1)^2} - 1}{1.71} = 1$$

$$U_{54} = \frac{e^{(0)^2} - 1}{1.71} = 0$$

$$U_{64} = \frac{e^{(0)^2} - 1}{1.71} = 0$$

$$U_{74} = \frac{e^{(0.33)^2} - 1}{1.71} = 0.08$$

For Criterion C₅

$$U_{15} = \frac{e^{(1)^2} - 1}{1.71} = 1$$

$$U_{25} = \frac{e^{(0)^2} - 1}{1.71} = 0$$

$$U_{35} = \frac{e^{(0.62)^2} - 1}{1.71} = 0.20$$

$$U_{45} = \frac{e^{(0.5)^2} - 1}{1.71} = 0.33$$

$$U_{55} = \frac{e^{(0.12)^2} - 1}{1.71} = 0.57$$

$$U_{65} = \frac{e^{(0.37)^2} - 1}{1.71} = 0.44$$

$$U_{75} = \frac{e^{(0.87)^2} - 1}{1.71} = 0.17$$

For Criterion C₆

$$U_{16} = \frac{e^{(0.5)^2} - 1}{1.71} = 0.17$$

$$U_{26} = \frac{e^{(0.16)^2} - 1}{1.71} = 0.02$$

$$U_3 = \frac{e^{(0.33)^2} - 1}{1.71} = 0.07$$

$$U_{46} = \frac{e^{(0.83)^2} - 1}{1.71} = 0.58$$

$$U_{56} = \frac{e^{(0.66)^2} - 1}{1.71} = 0.32$$

$$U_{66} = \frac{e^{(0)^2} - 1}{1.71} = 0$$

$$U_{76} = \frac{e^{(1)^2} - 1}{1.71} = 1$$

For Criterion C₇

$$U_{17} = \frac{e^{(0.5)^2} - 1}{1.71} = 0.17$$

$$U_{27} = \frac{e^{(1)^2} - 1}{1.71} = 1$$

$$U_{37} = \frac{e^{(0.75)^2} - 1}{1.71} = 0.44$$

$$U_{47} = \frac{e^{(0.25)^2} - 1}{1.71} = 0.04$$

$$U_{57} = \frac{e^{(0)^2} - 1}{1.71} = 0$$

$$U_{67} = \frac{e^{(1)^2} - 1}{1.71} = 1$$

$$U_{77} = \frac{e^{(0.5)^2} - 1}{1.71} = 0.17$$

From the calculations that have been conducted, the final marginal utility values are obtained, as shown in table 10:

Table 10. Final Marginal Utility Results

Alternative	C ₁	C ₂	C ₃	C ₄	C ₅	C ₆	C ₇
A ₁	0.32	1	0.07	1	1	0.17	0.17
A ₂	0.07	0.38	0.32	0.08	0	0.02	1
A ₃	0	0.05	1	0.32	0.20	0.07	0.44
A ₄	1	0.25	0.07	1	0.33	0.58	0.04
A ₅	0.07	0.01	0	0	0.57	0.32	0
A ₆	0.07	0	0.32	0	0.44	0	1
A ₇	1	0.13	1	0.08	0.17	1	0.17

4. Calculating the Final Utility Values (U_i)

$$U_1 = (0.37 * 0.32) + (0.23 * 1) + (0.16 * 0.07) + (0.11 * 1) + (0.07 * 1) + (0.04 * 0.17) + (0.02 * 0.17) = 0.5498$$

$$U_2 = (0.37 * 0.07) + (0.23 * 0.38) + (0.16 * 0.32) + (0.11 * 0.08) + (0.07 * 0) + (0.04 * 0.02) + (0.02 * 1) = 0.1761$$

$$U_3 = (0.37 * 0) + (0.23 * 0.05) + (0.16 * 1) + (0.11 * 0.32) + (0.07 * 0.20) + (0.04 * 0.07) + (0.02 * 0.44) = 0.2323$$

$$U_4 = (0.37 * 1) + (0.23 * 0.25) + (0.16 * 0.07) + (0.11 * 1) + (0.07 * 0.33) + (0.04 * 0.58) + (0.02 * 0.04) = 0.5958$$

$$U_5 = (0.37 * 0.07) + (0.23 * 0.01) + (0.16 * 0) + (0.11 * 0) + (0.07 * 0.57) + (0.04 * 0.32) + (0.02 * 0) = 0.0809$$

$$U_6 = (0.37 * 0.07) + (0.23 * 0) + (0.16 * 32) + (0.11 * 0) + (0.07 * 0.44) + (0.04 * 0) + (0.02 * 1) = 0.6847$$

$$U_7 = (0.37 * 1) + (0.23 * 0.13) + (0.16 * 1) + (0.11 * 0.08) + (0.07 * 0.17) + (0.04 * 1) + (0.02 * 0.17) = 0.1725$$

The attainment of final utility values that serve as rankings can be observed as table 11:

Table 11. Alternative Rankings

Alternative	New Branch Location Name	Utility Value U_i	Ranking
A ₁	Sultan Serdang Street	0.5498	3
A ₂	Lubuk Pakam Street	0.1761	5
A ₃	Limau Manis Street	0.2323	4
A ₄	Bt. Kuis Street	0.5958	2
A ₅	Kapten Muslim Street	0.0809	7
A ₆	Wonosari Street	0.6847	1
A ₇	Kualanamu Street	0.1725	6

From the calculations conducted using the MAUT method and ROC weighting, the alternative deemed suitable according to the criteria for the new branch location is A₆, which stands out as the best alternative with a score of 0.6847 on Jalan Wonosari.

4. CONCLUSION

From the application conducted by the author using the MAUT method with the assistance of ROC weighting in the process of selecting a new branch location, the best output from the initial ranking is obtained for each alternative and criterion. In the study, there are 7 alternatives and 7 criteria. After applying the MAUT and ROC methods, the highest preference value is obtained for alternative A₆, amounting to 0.6847, located on Jalan Wonosari as the recommended choice for the new branch location.

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